US006467648B1

(12) **United States Patent**
Nishiyama et al.

(10) **Patent No.: US 6,467,648 B1**
(45) **Date of Patent: Oct. 22, 2002**

(54) **PRODUCT DELIVERING DEVICE AND PRODUCT DELIVERING METHOD OF AUTOMATIC VENDING MACHINE**

(75) Inventors: **Takashi Nishiyama**, Saitama-ken (JP); **Yoshitake Yokota**, Saitama-ken (JP); **Hideki Fujimoto**, Saitama-ken (JP); **Hiroaki Usuki**, Saitama-ken (JP)

(73) Assignee: **Sanyo Electric Co., Ltd.**, Osaka-Fu (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 73 days.

(21) Appl. No.: **09/721,707**

(22) Filed: **Nov. 27, 2000**

(30) **Foreign Application Priority Data**

Nov. 26, 1999 (JP) 11-336593

(51) **Int. Cl.**[7] **G07F 11/00**

(52) **U.S. Cl.** **221/7**; 221/289

(58) **Field of Search** 221/2, 7, 15, 13, 221/247, 245, 268, 289, 131, 129, 123; 700/231, 241

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,019,246 A * 2/2000 Yajima et al. 221/2
6,241,121 B1 * 6/2001 Yasaka 221/226

* cited by examiner

Primary Examiner—Kenneth W. Noland
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

A stopper which projects into the product passage to support the product to be sold, an ejector which projects into the product passage to support the product to be sold next immediately after the product to be sold, and control means for controlling the projection quantity into the product passage of the stopper and the ejector, wherein the control means, upon receipt of a sales instruction, allows the ejector to project into the product passage to support the product to be sold next, opens the stopper to deliver the product to be sold from the product passage to a sales port and closes the product passage with the stopper after the delivery of the sales product while supplying the product to be sold next by recessing the ejector. As a consequence, irrespective of the size and the configuration of the product to be sold, only the product to be sold can be delivered with certitude at the time of selling the product.

17 Claims, 30 Drawing Sheets

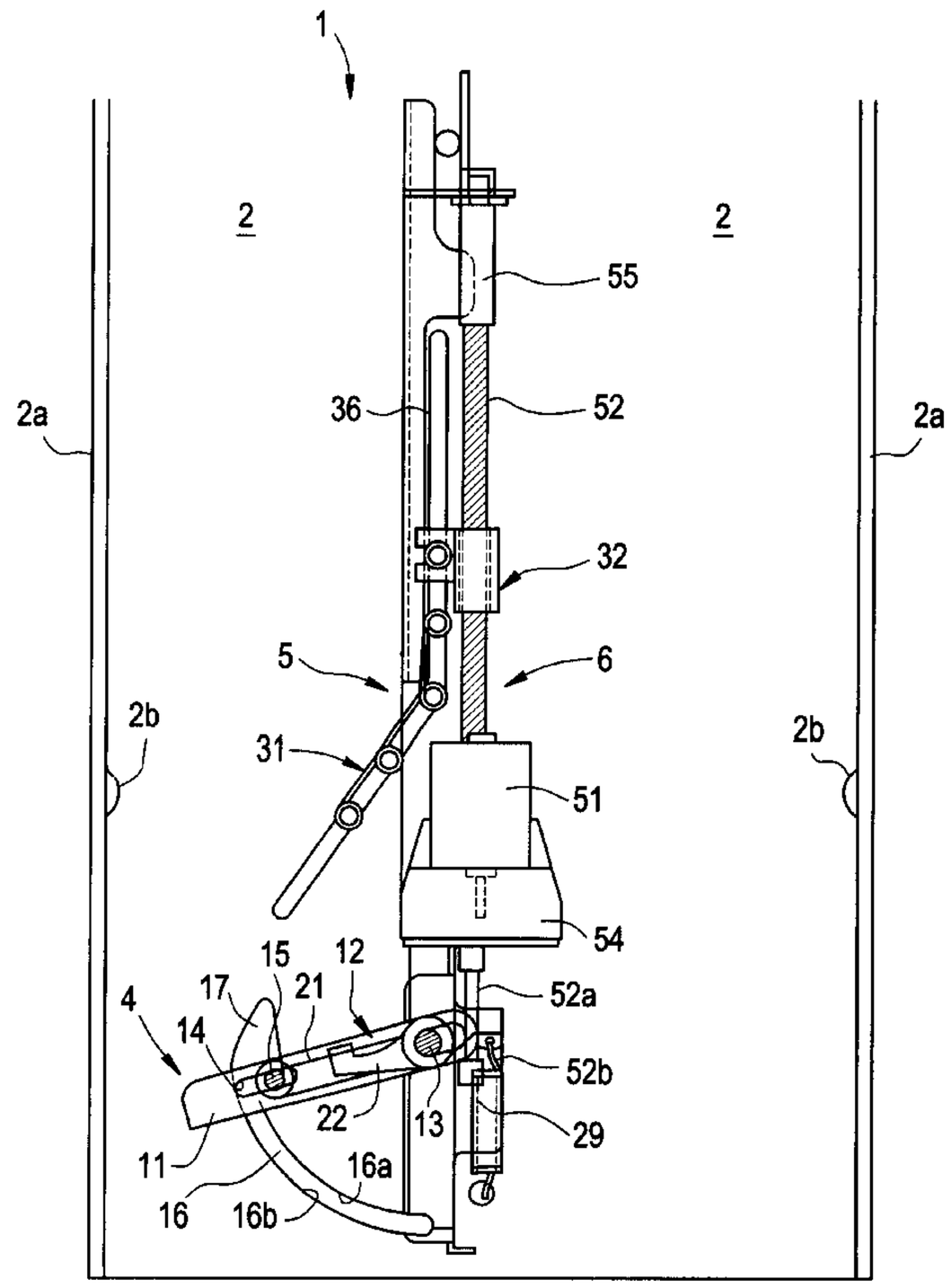


FIG. 1

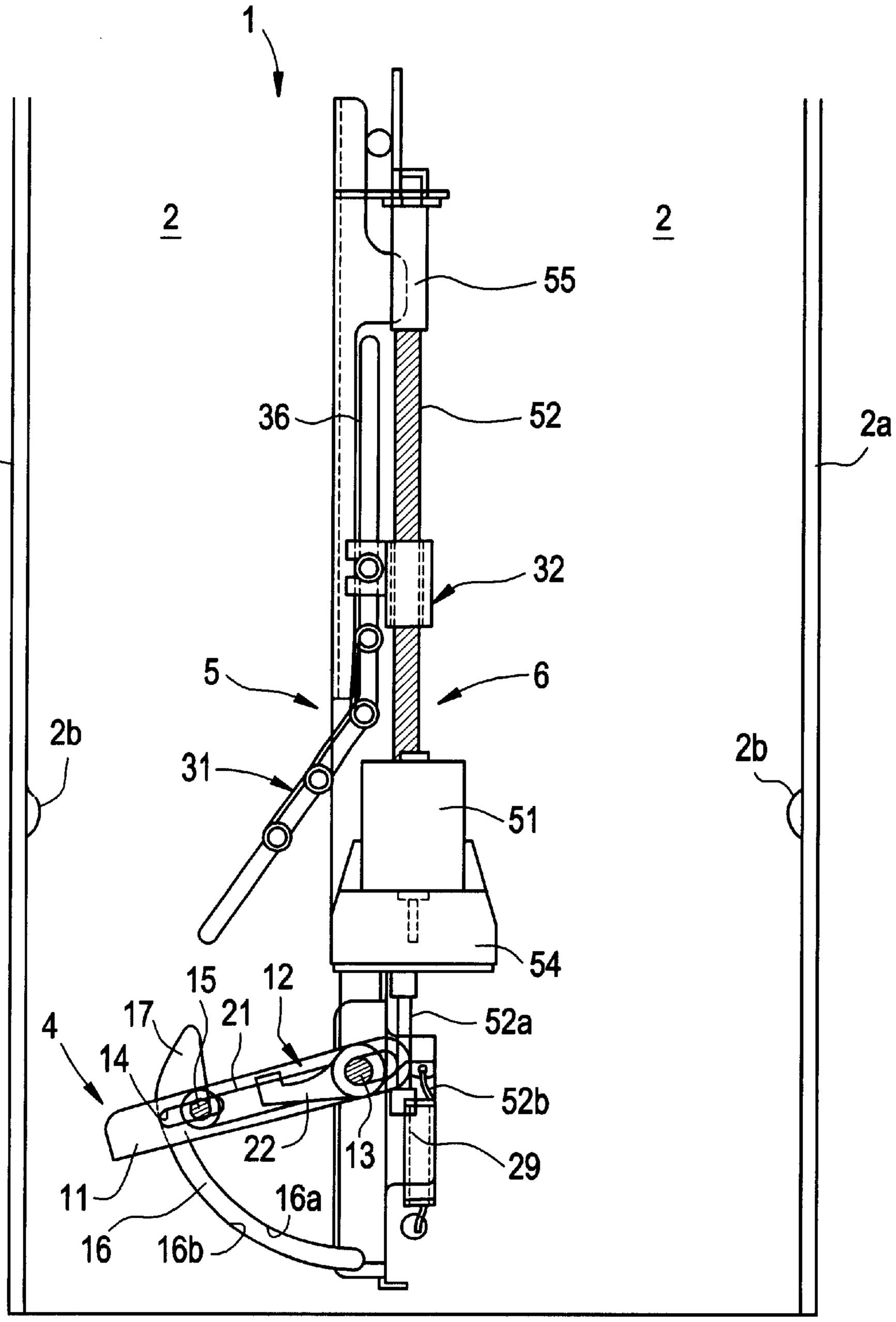

1
2
2
2a
2a
2b
2b
55
36
52
32
5
6
31
51
54
15
12
17
21
4
52a
14
52b
22
13
29
11
16a
16
16b

FIG. 2

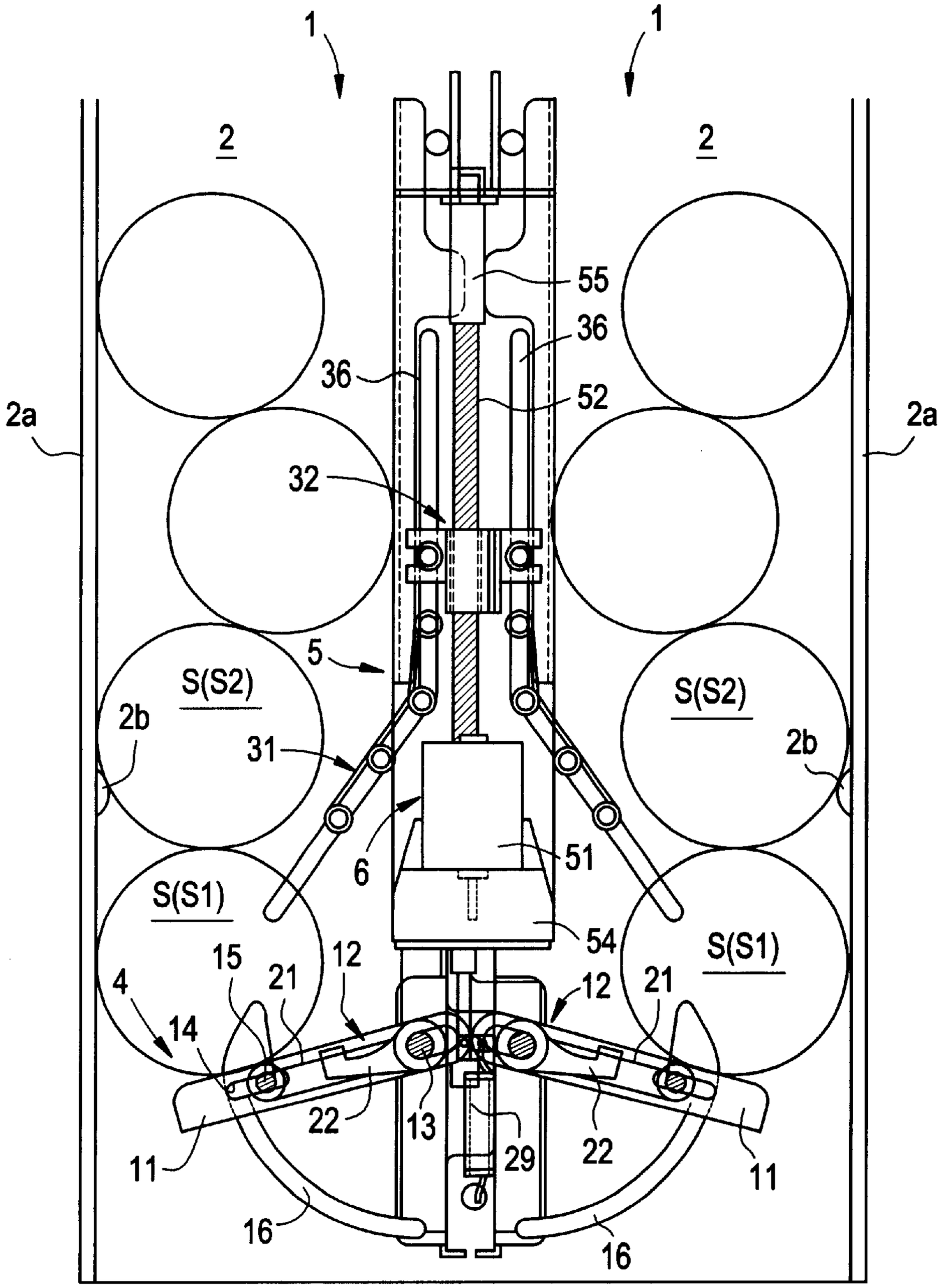

1
1
2
2
55
36
36
52
2a
2a
32
5
S(S2)
S(S2)
2b
2b
31
6
51
S(S1)
S(S1)
54
15
21
12
12
21
4
14
22
13
29
22
11
11
16
16

FIG. 3

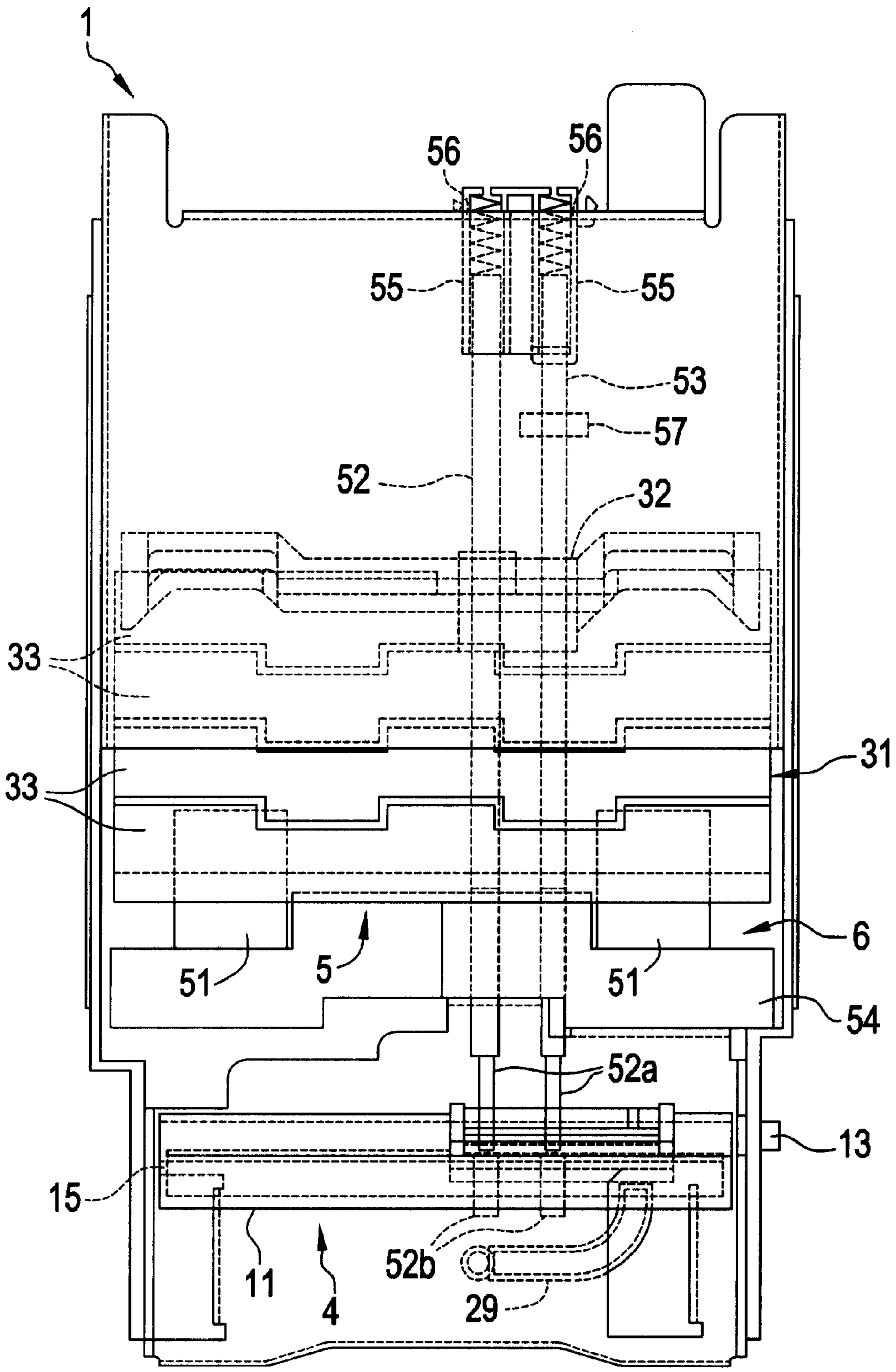


FIG. 4

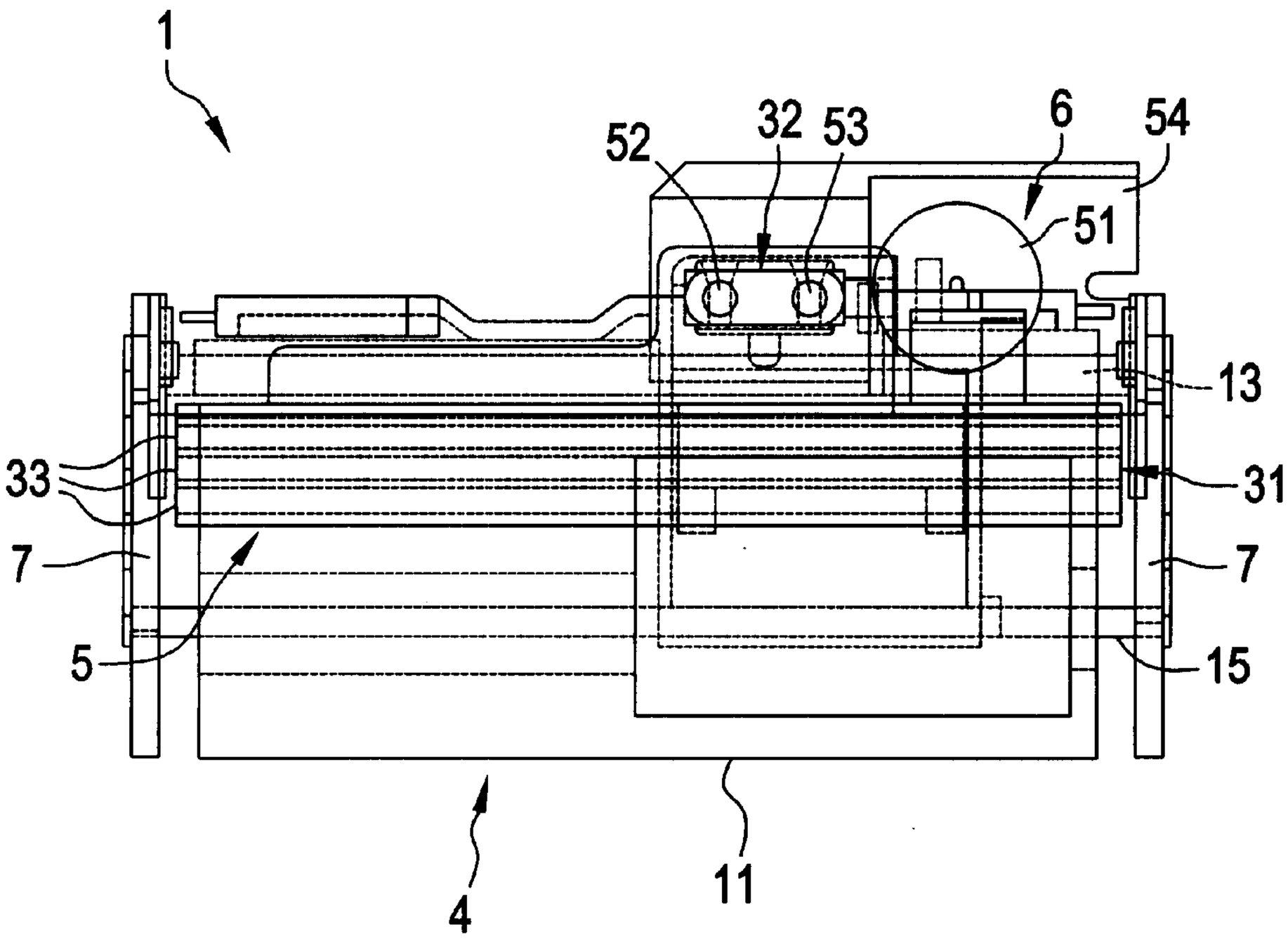


FIG. 5

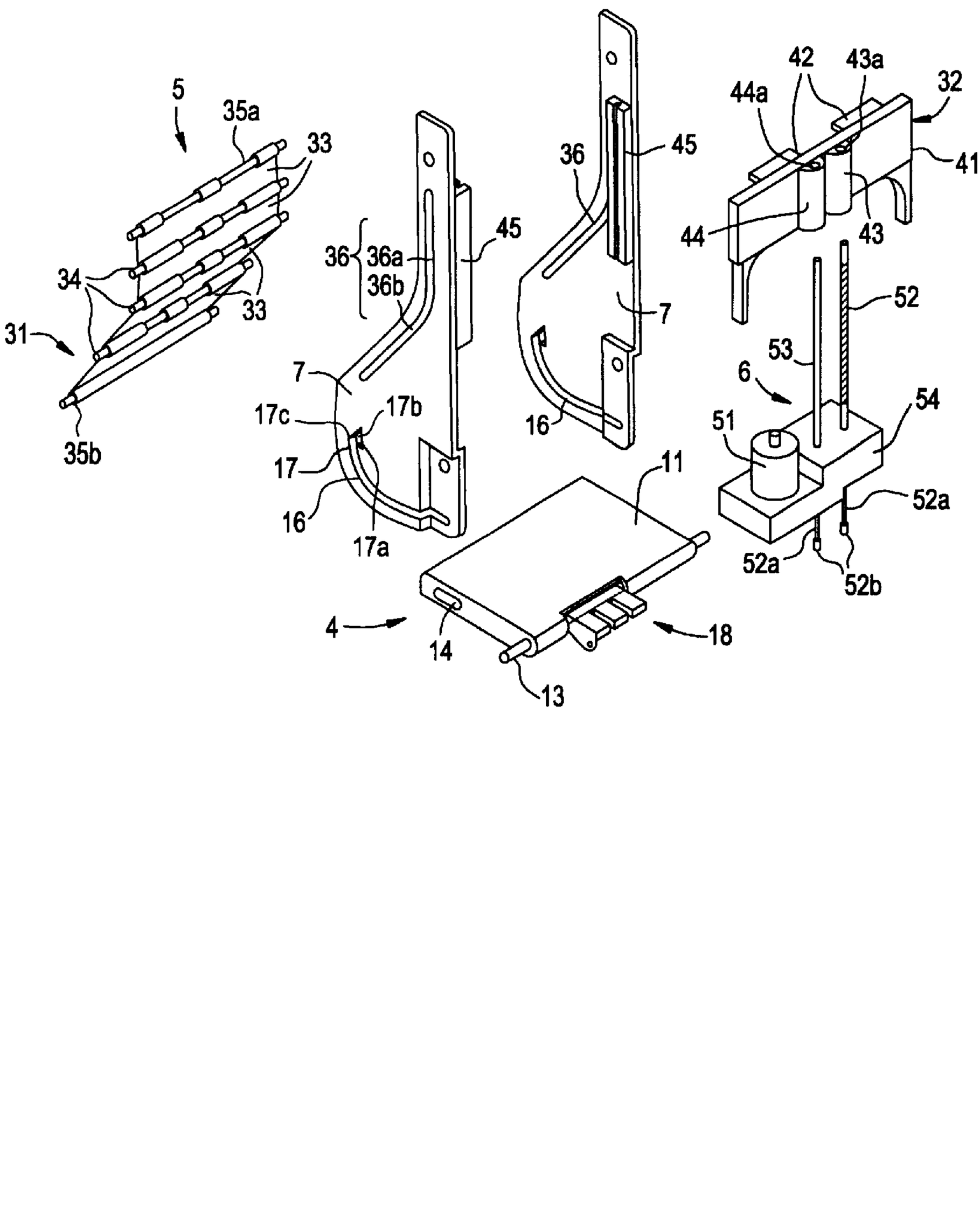

5
35a
33
34
33
31
35b
36
36a
36b
45
7
17c
17b
17
16
17a
4
14
13
18
11
42
43a
44a
32
41
44
43
52
53
6
54
51
52a
52b

FIG. 6

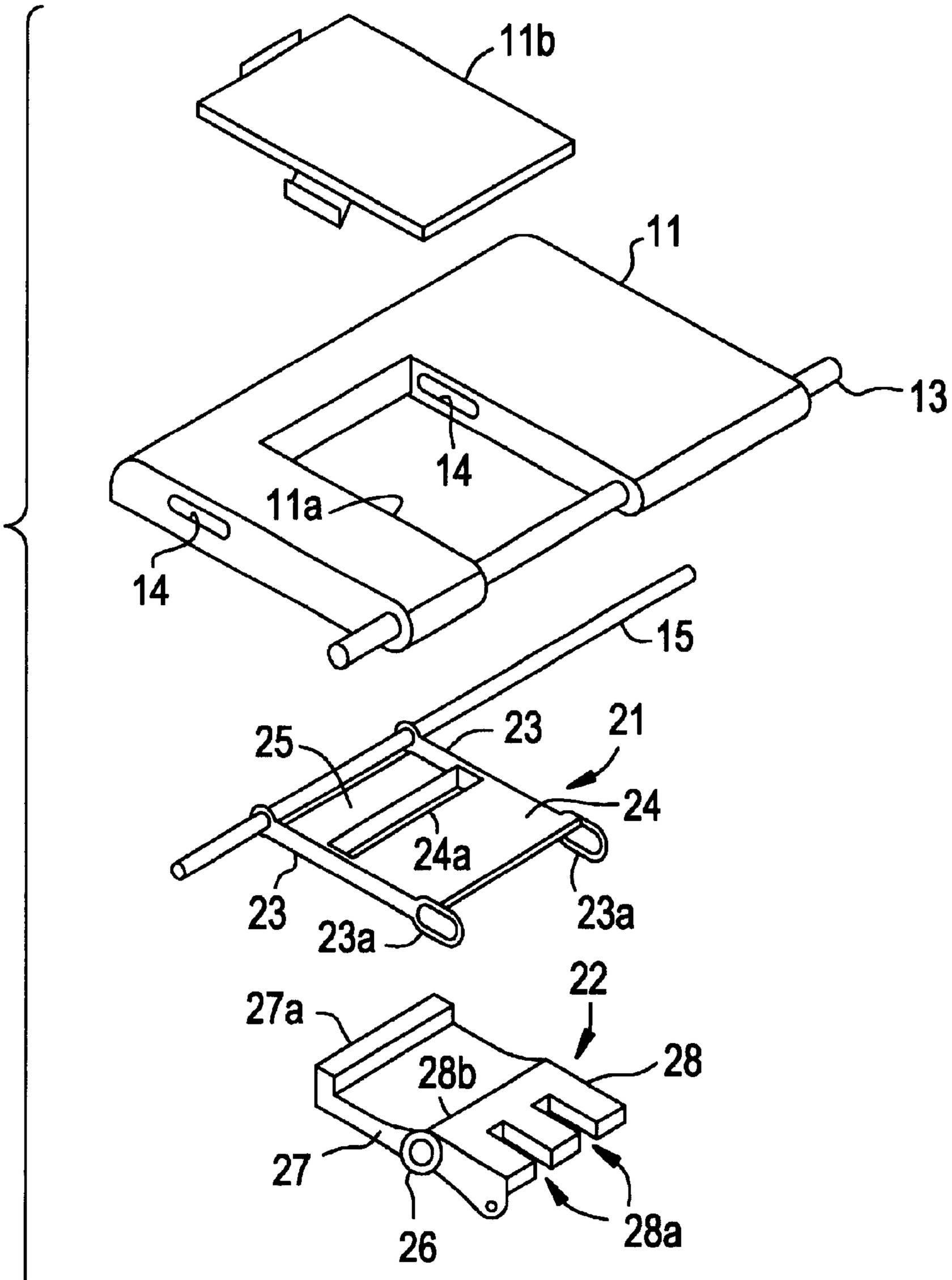

11b
11
13
14
11a
14
15
25
23
21
24
24a
23
23a
23a
22
27a
28b
28
27
26
28a

FIG. 7A

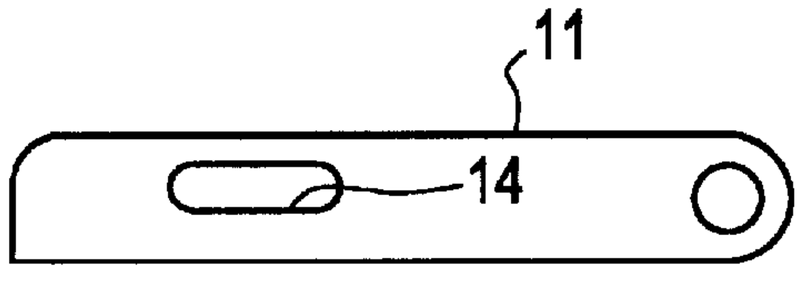


FIG. 7B

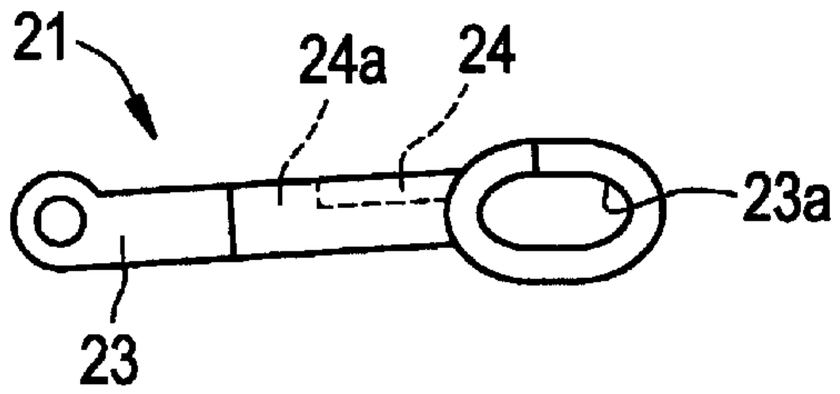


FIG. 7C

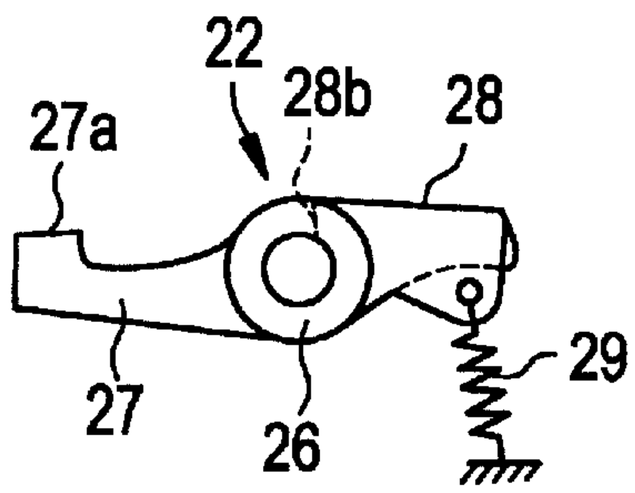


FIG. 7D

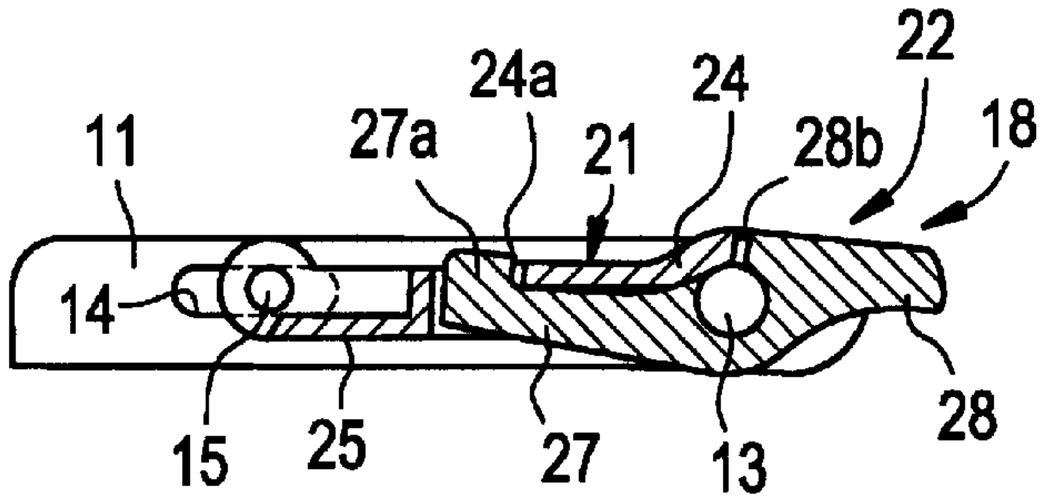


FIG. 8A

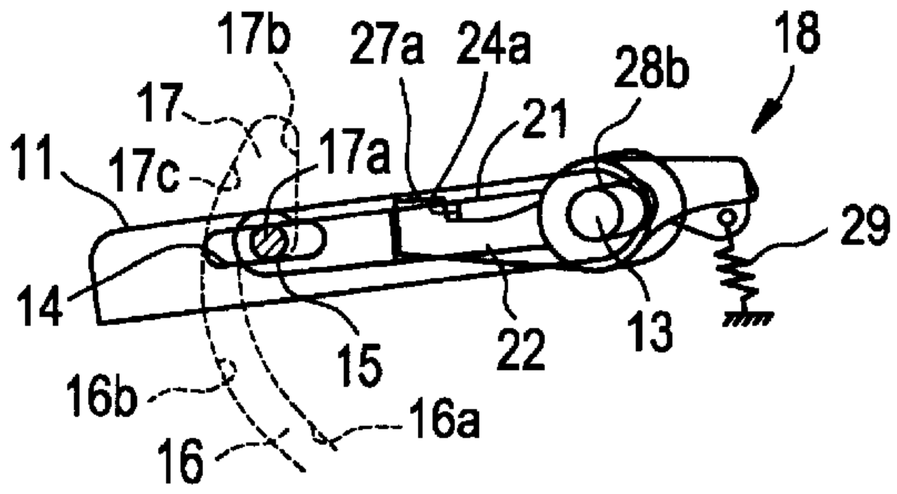


FIG. 8B

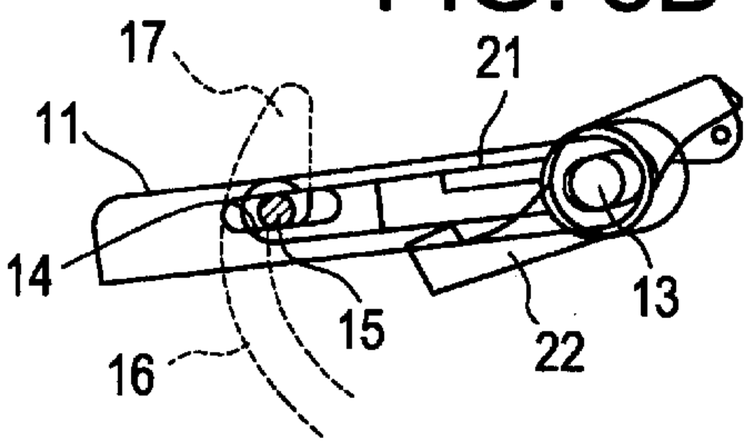


FIG. 8C

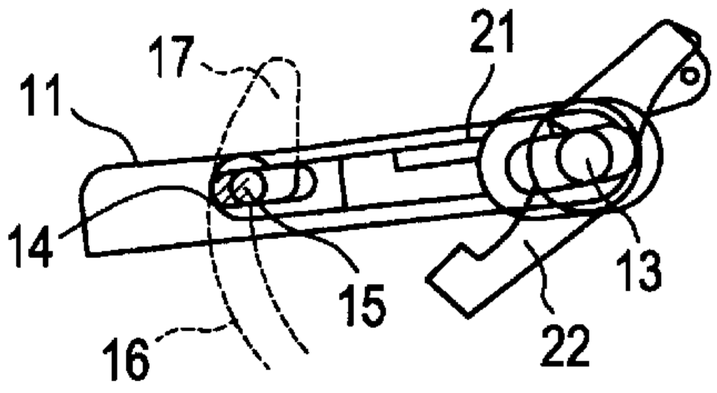


FIG. 8D

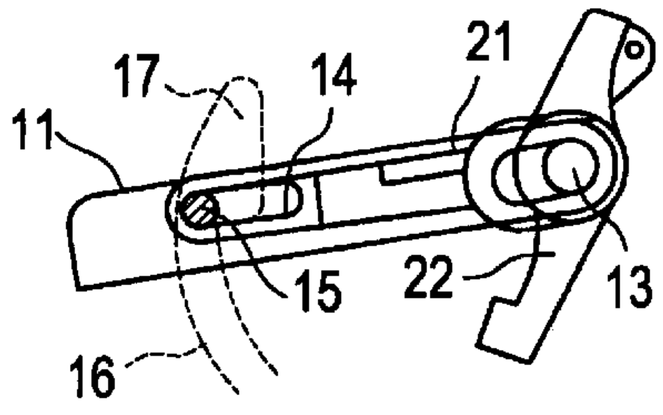


FIG. 8E

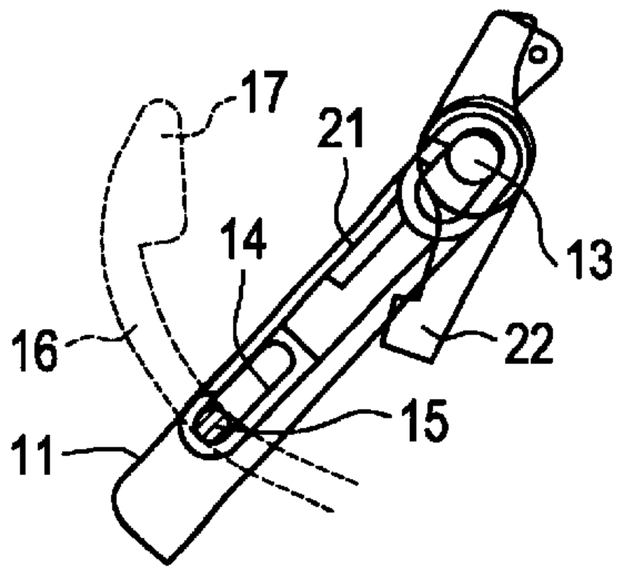


FIG. 8F

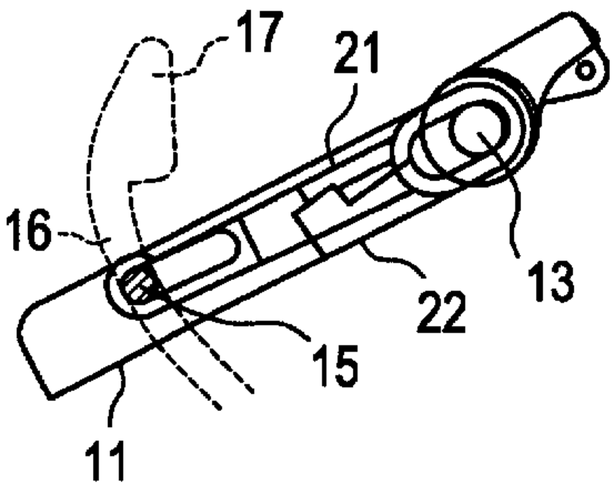


FIG. 8G

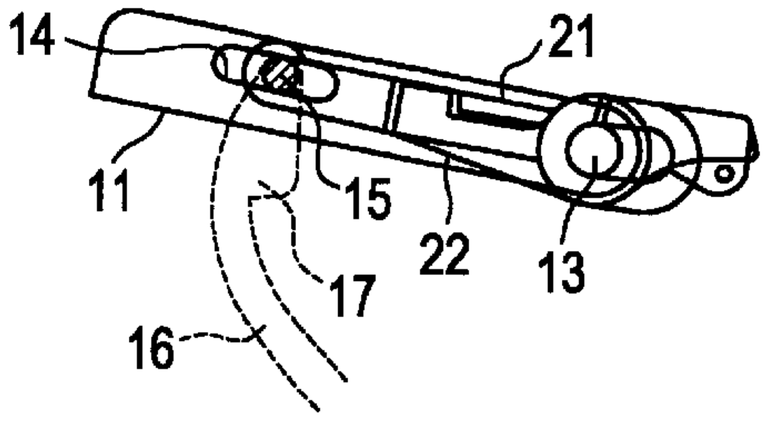


FIG. 8H

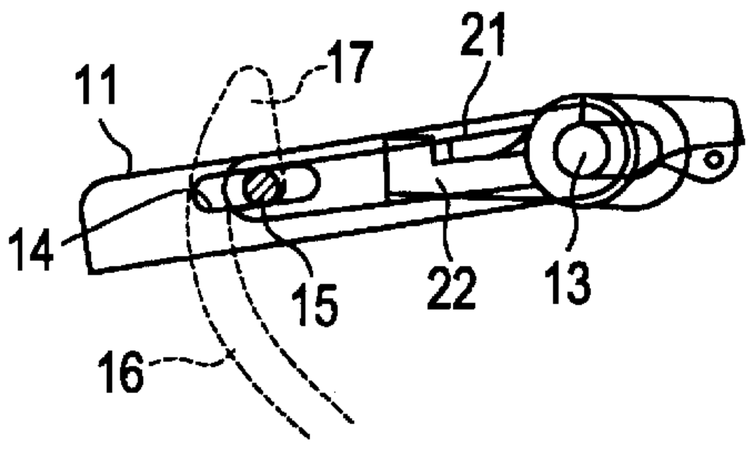


FIG. 9

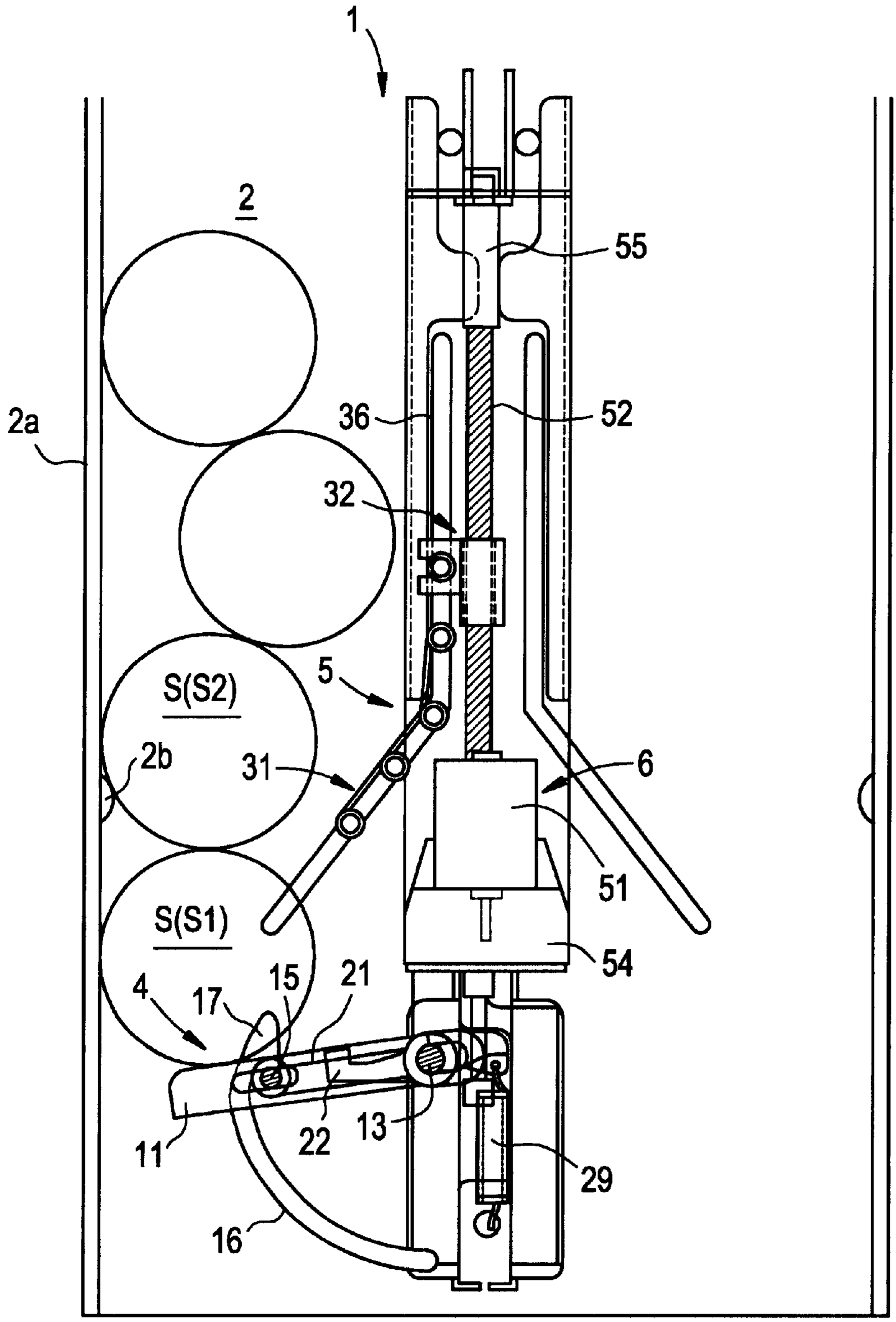


FIG. 10

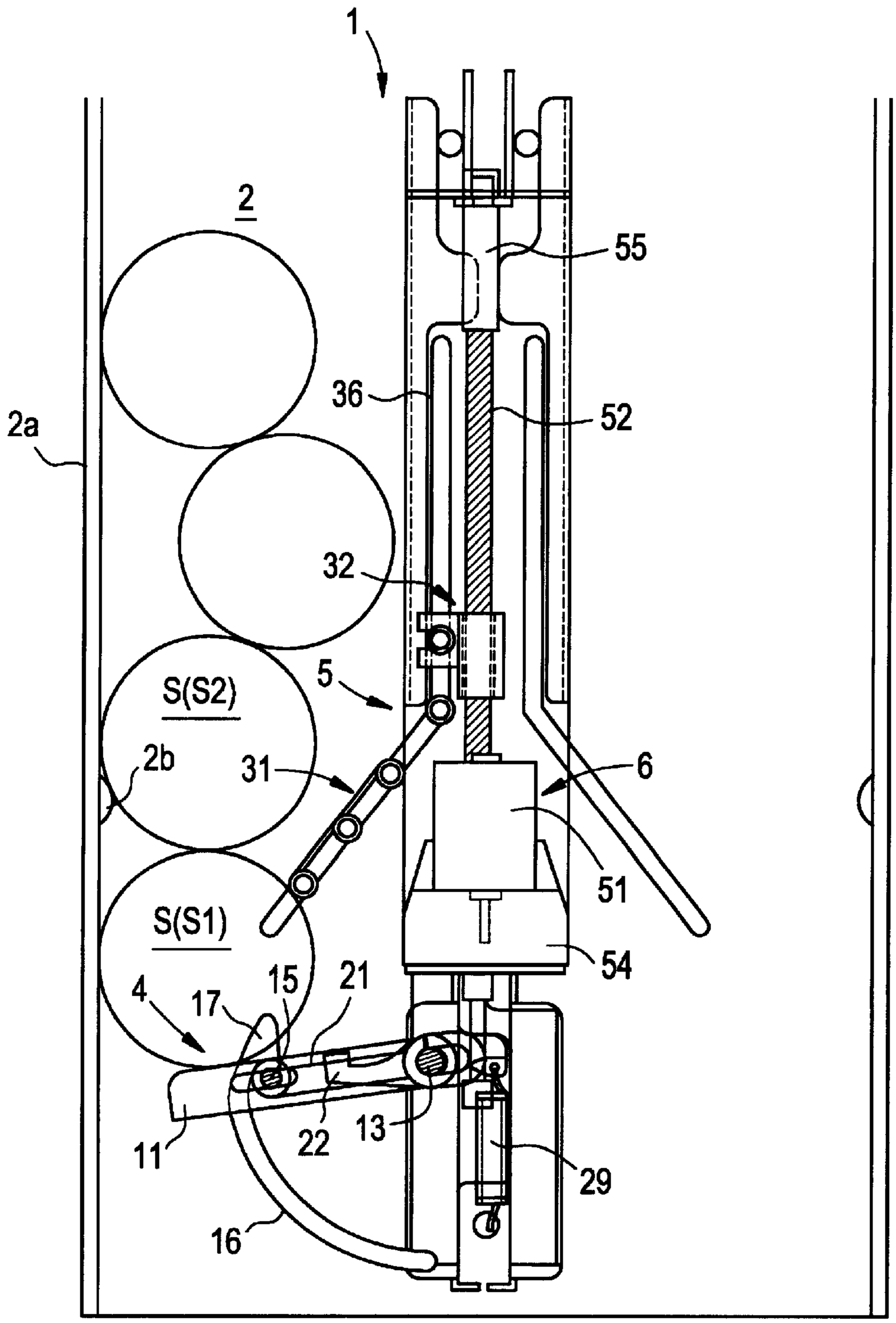


FIG. 11

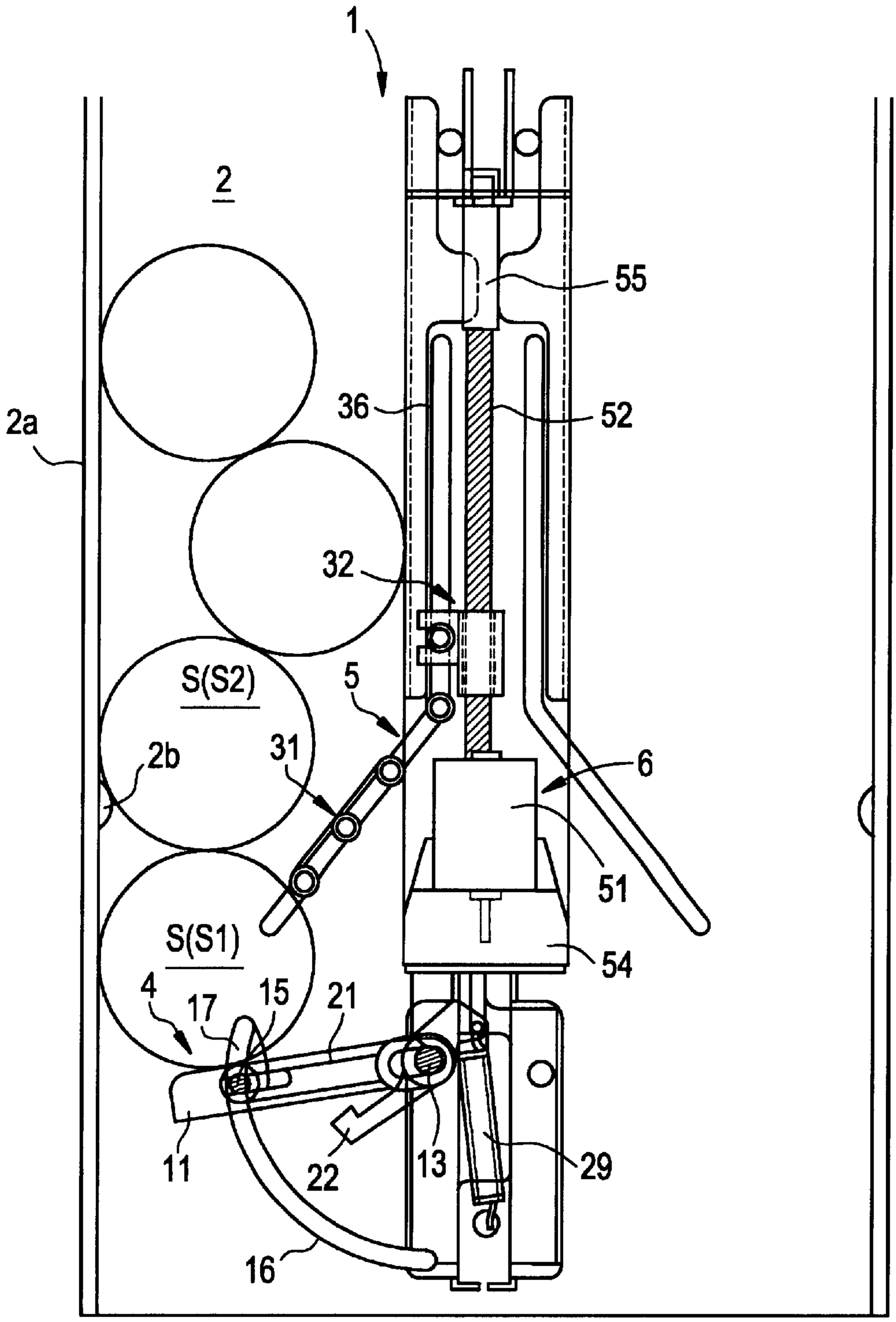


FIG. 12

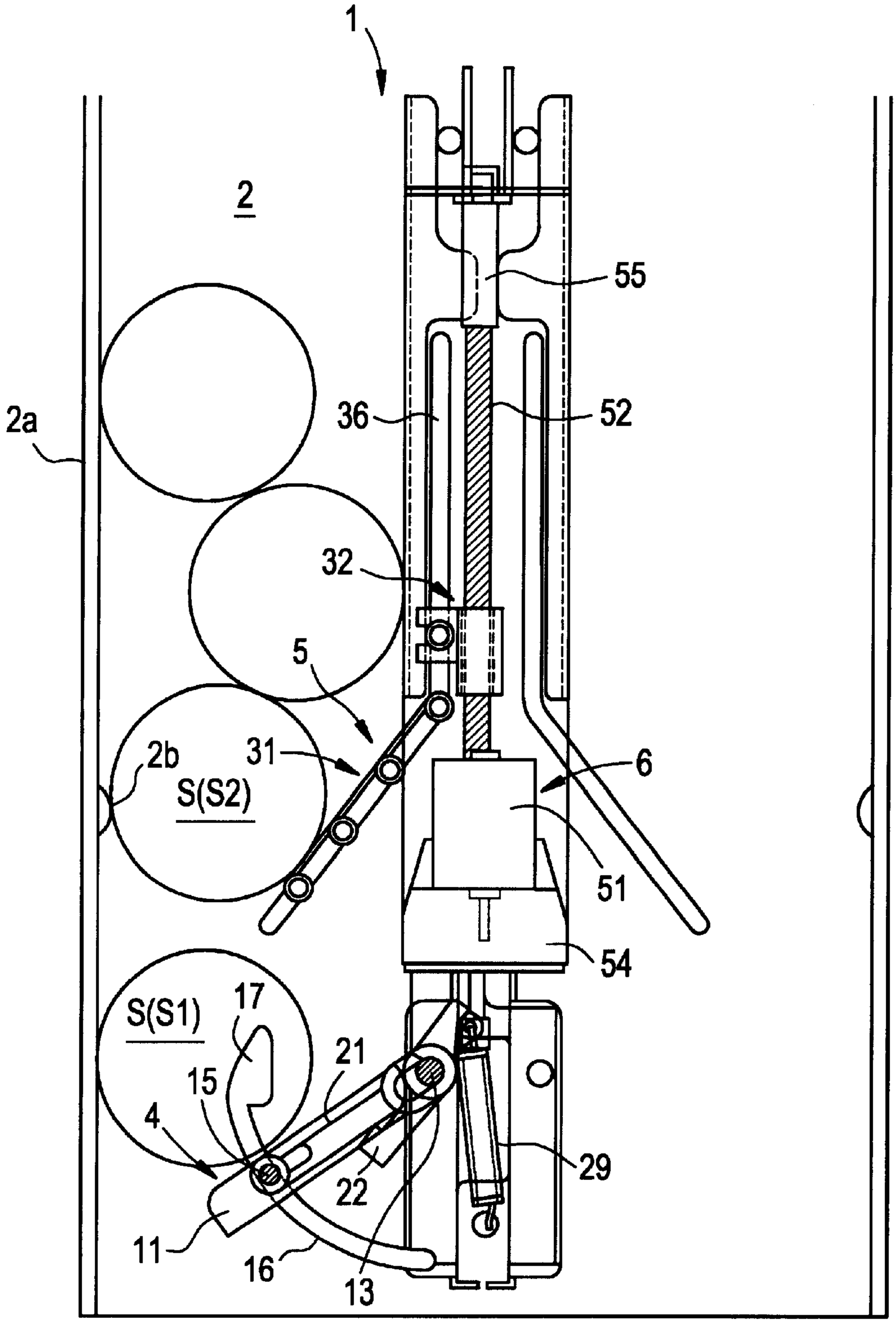


FIG. 13

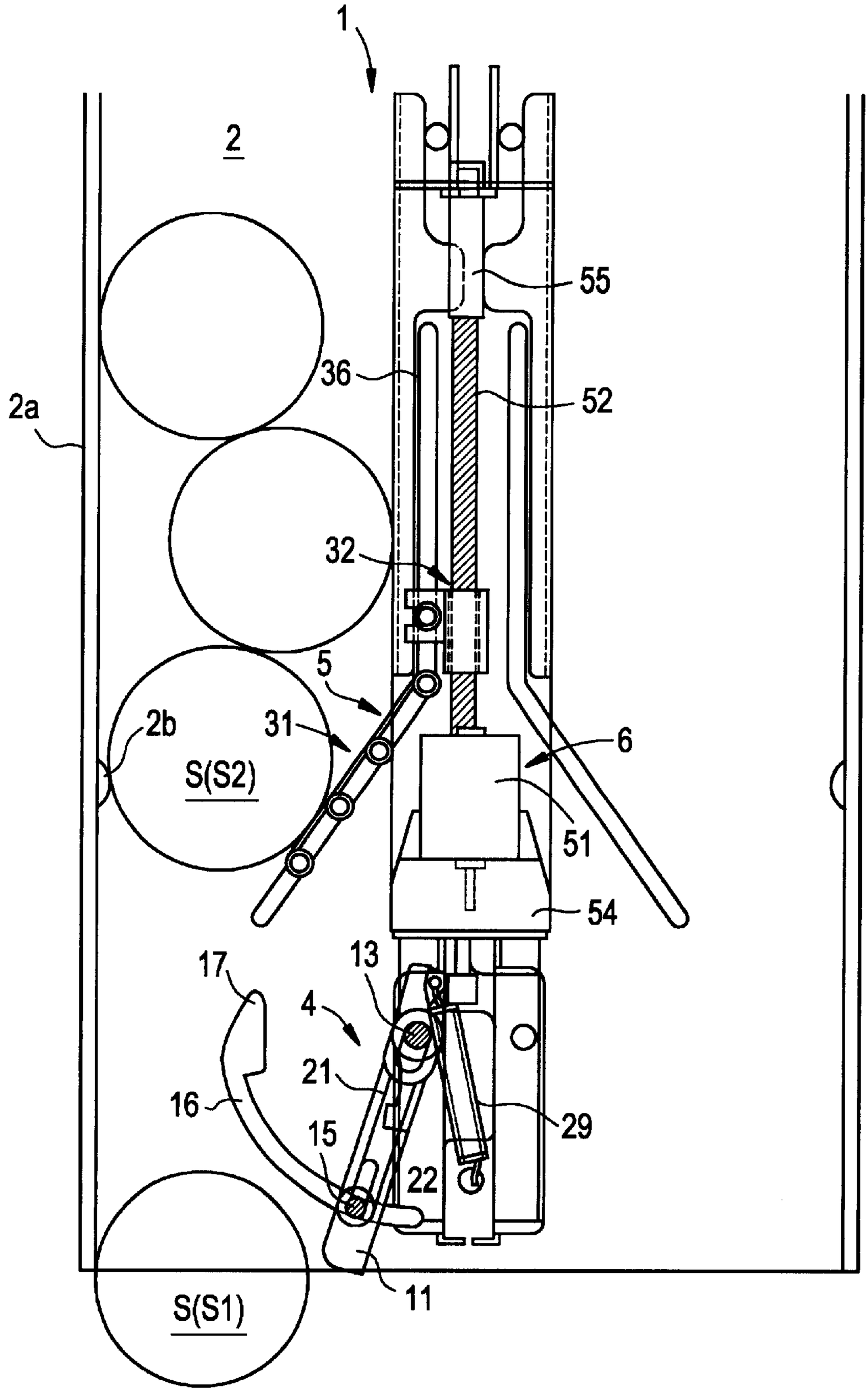


FIG. 14

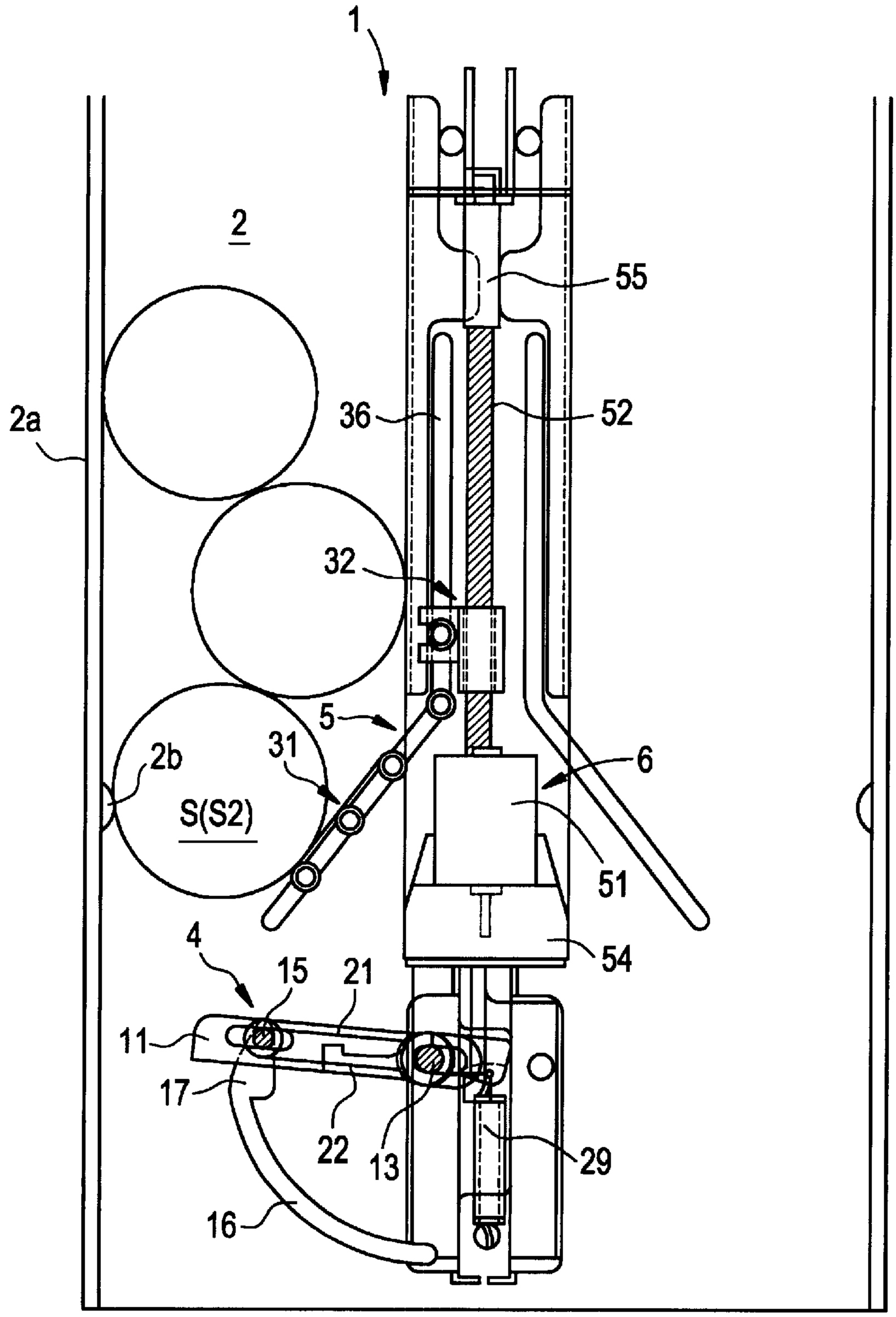


FIG. 15

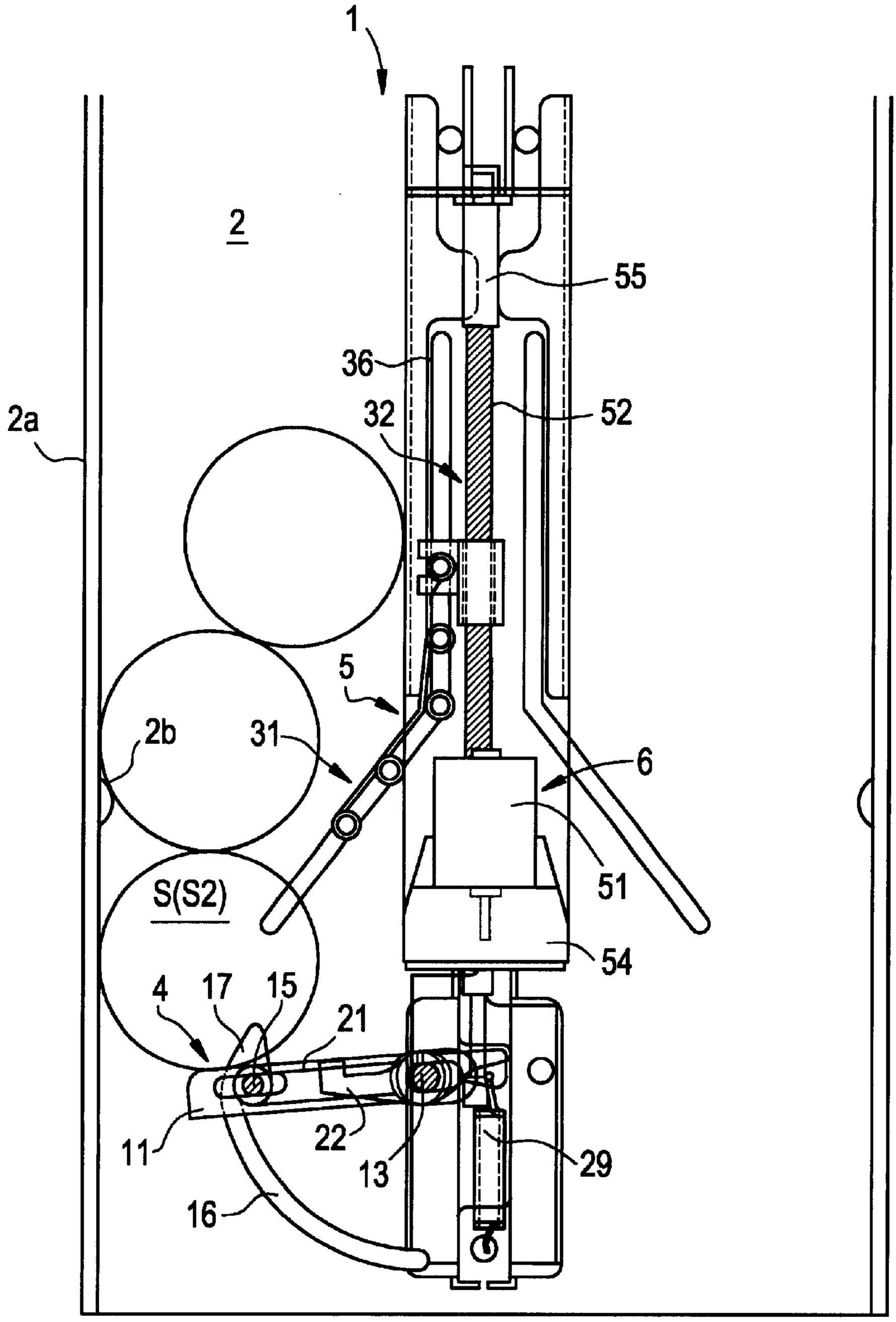


FIG. 16

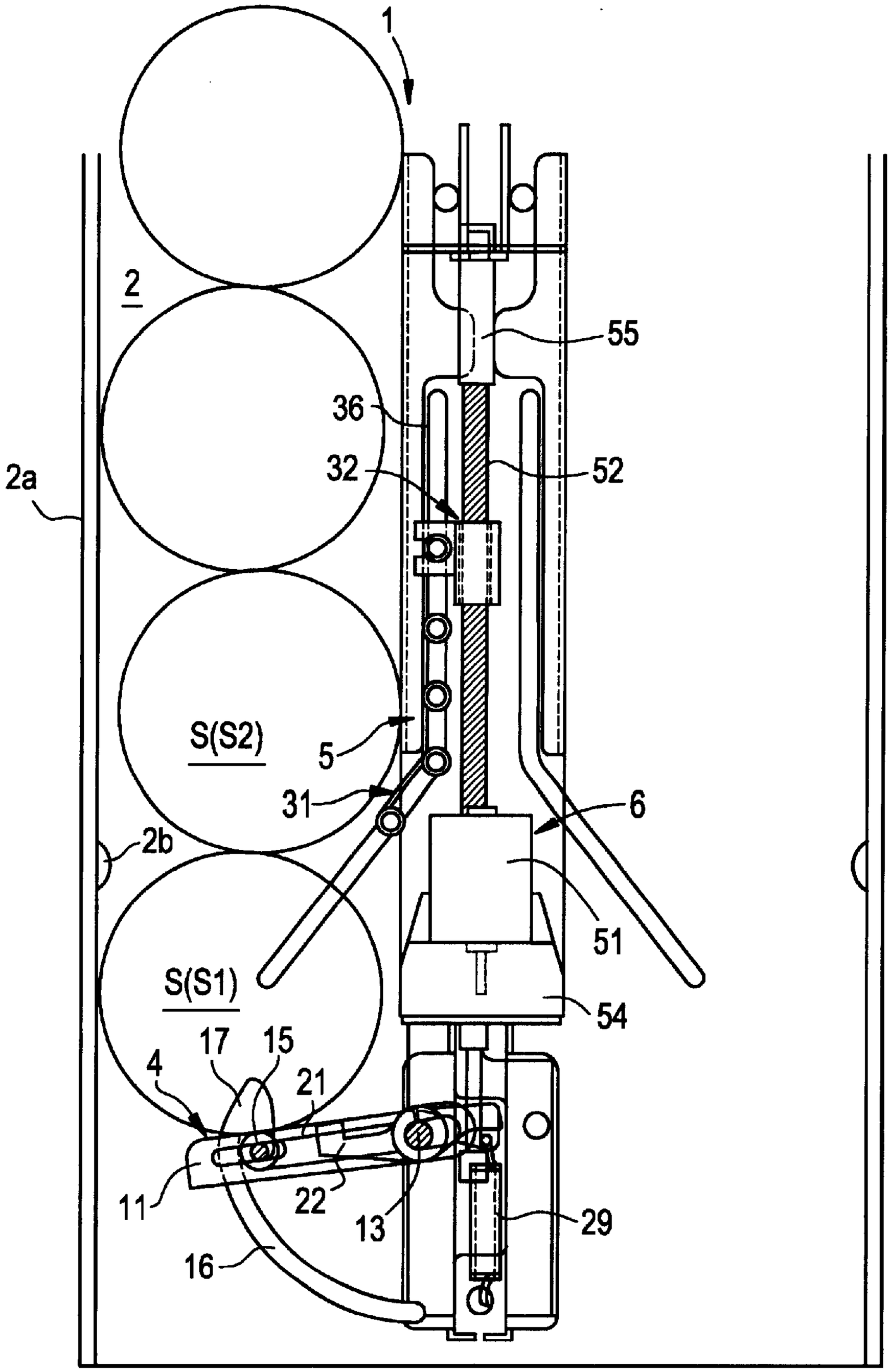


FIG. 17

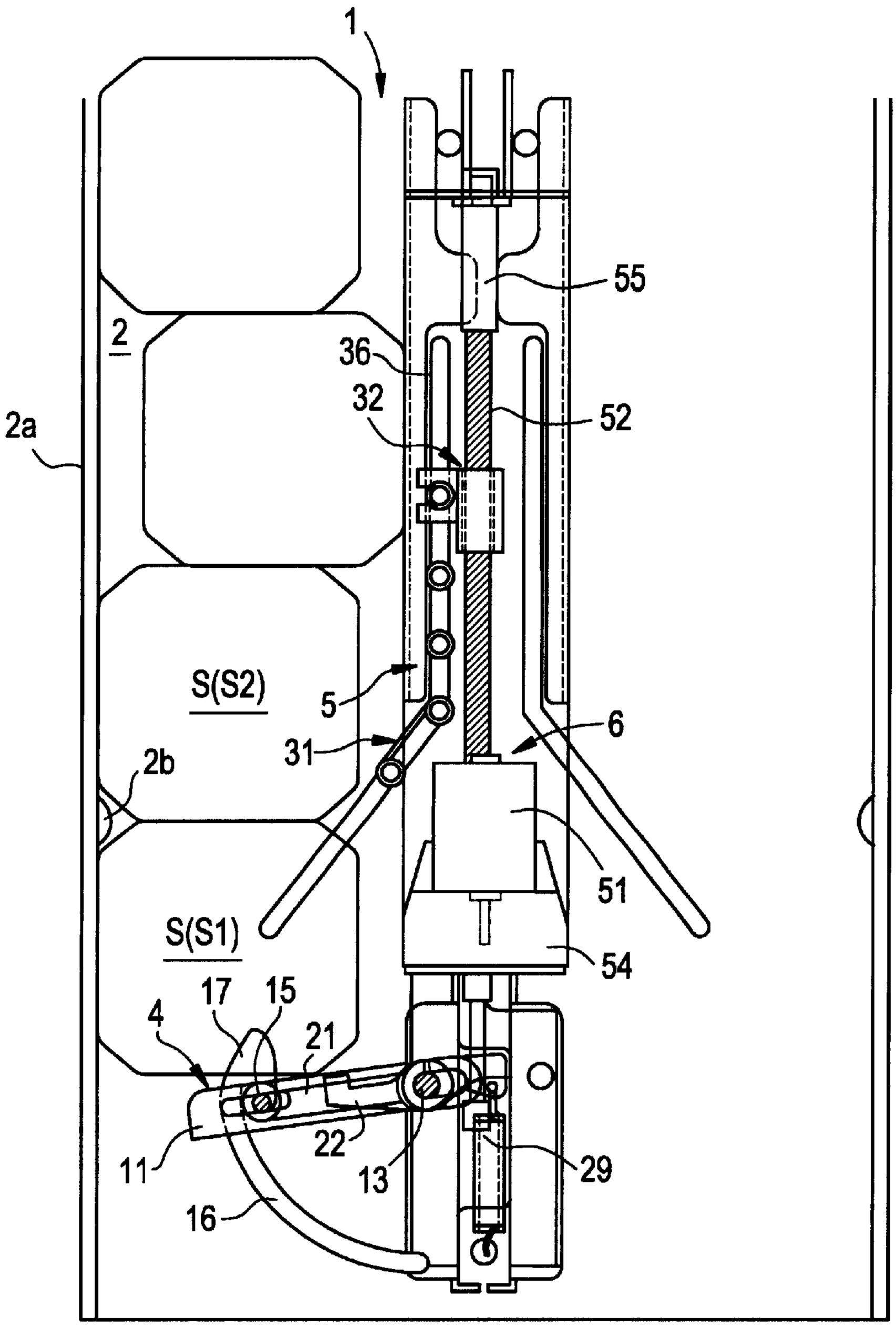


FIG. 18

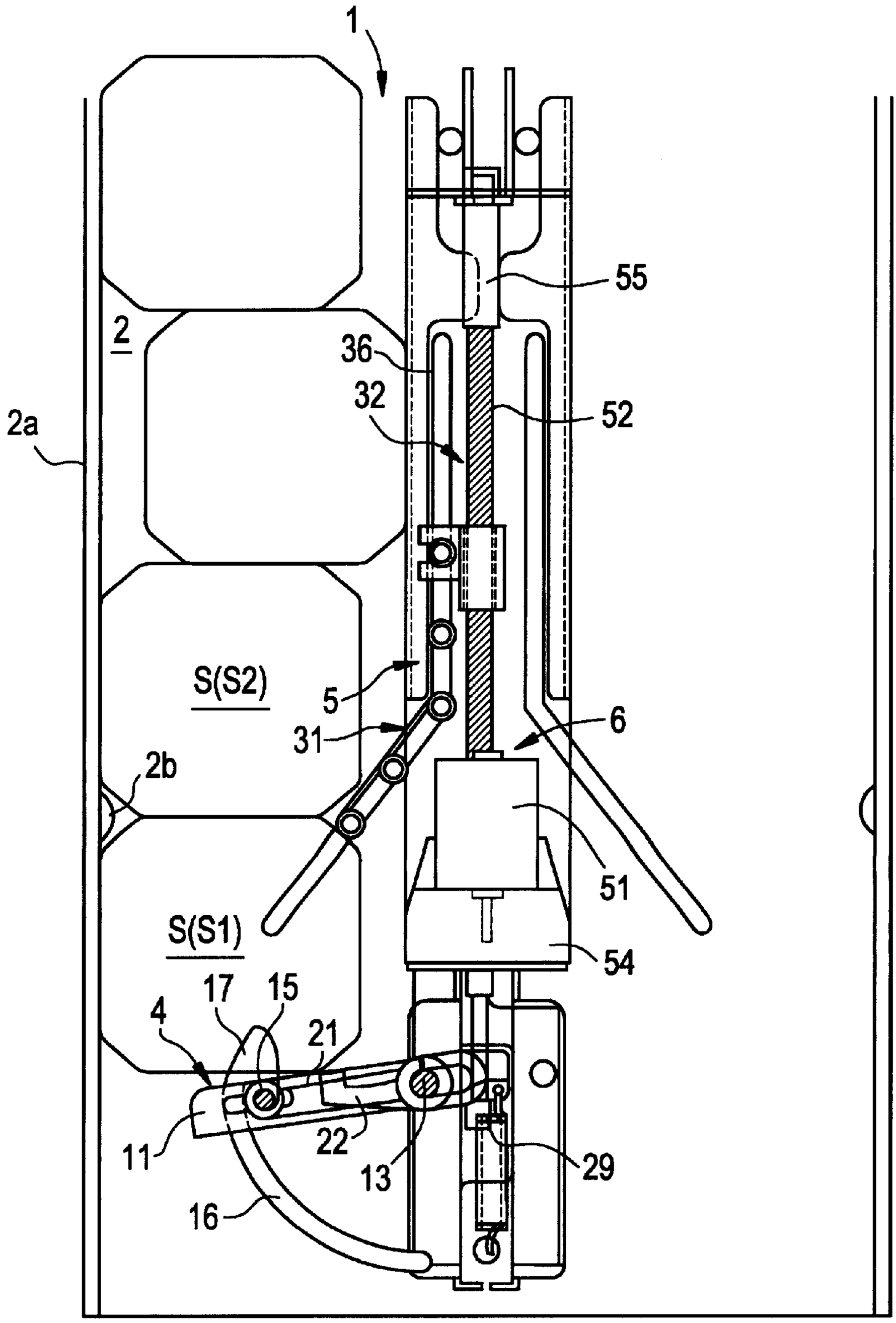


FIG. 19

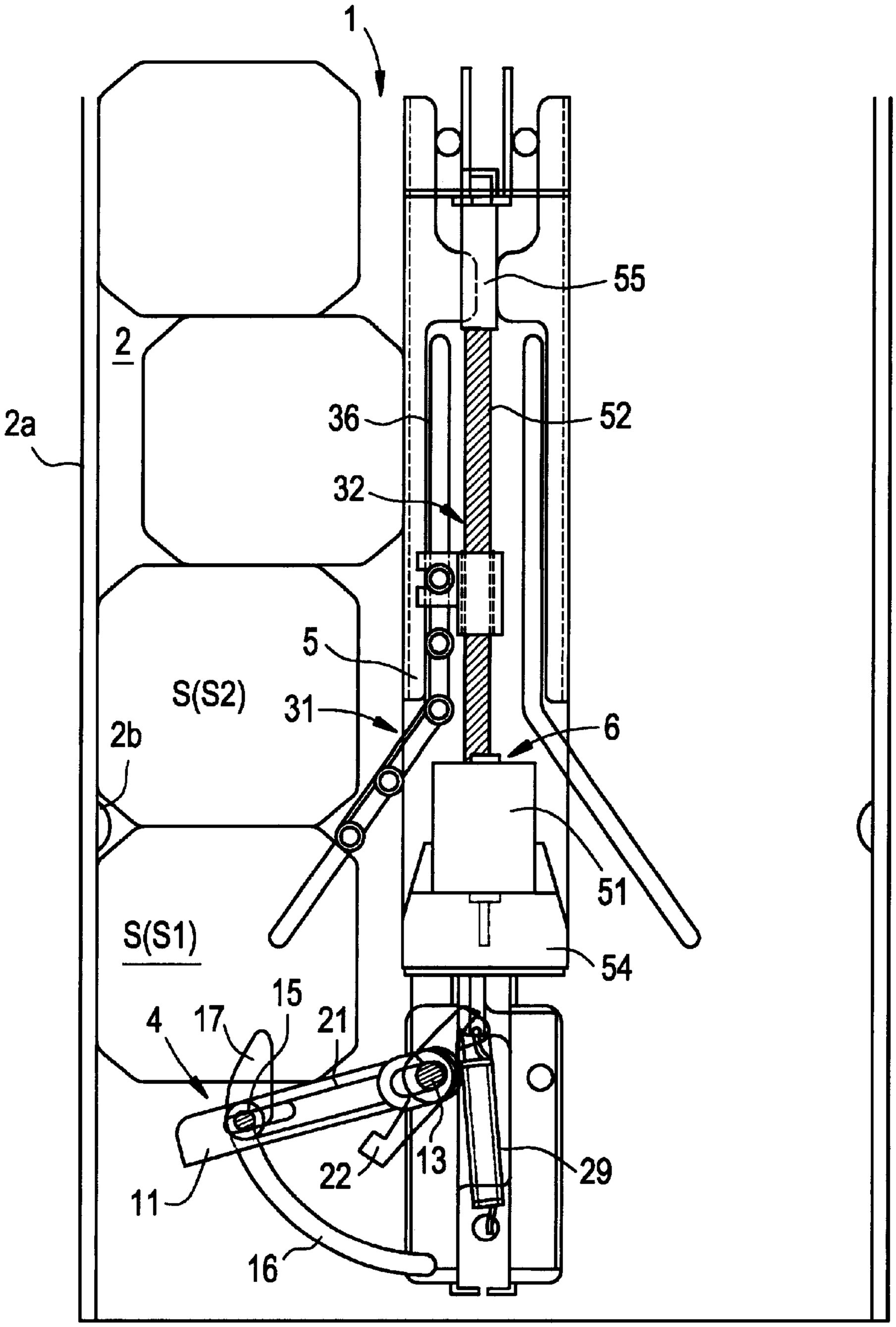


FIG. 20

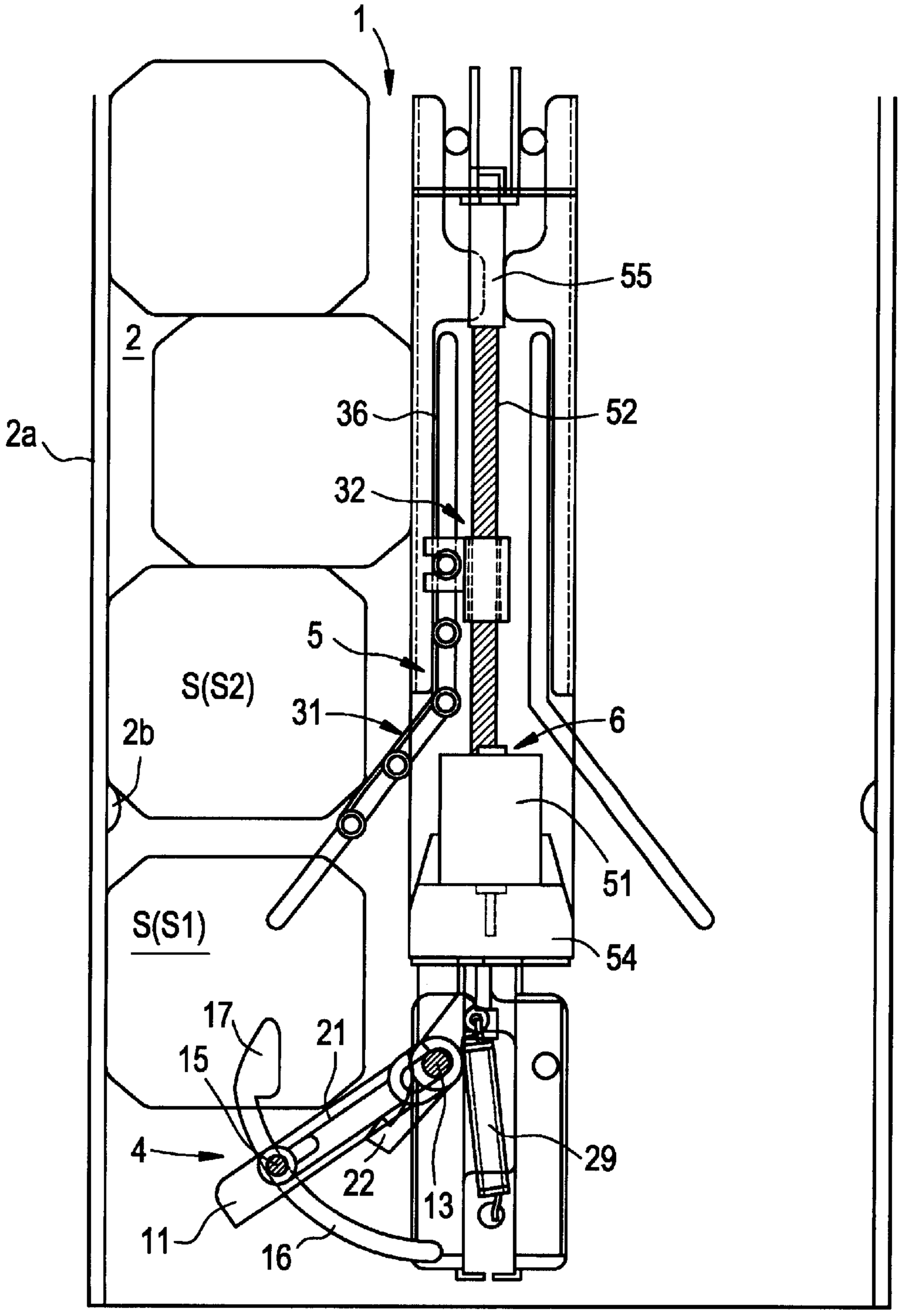


FIG. 21

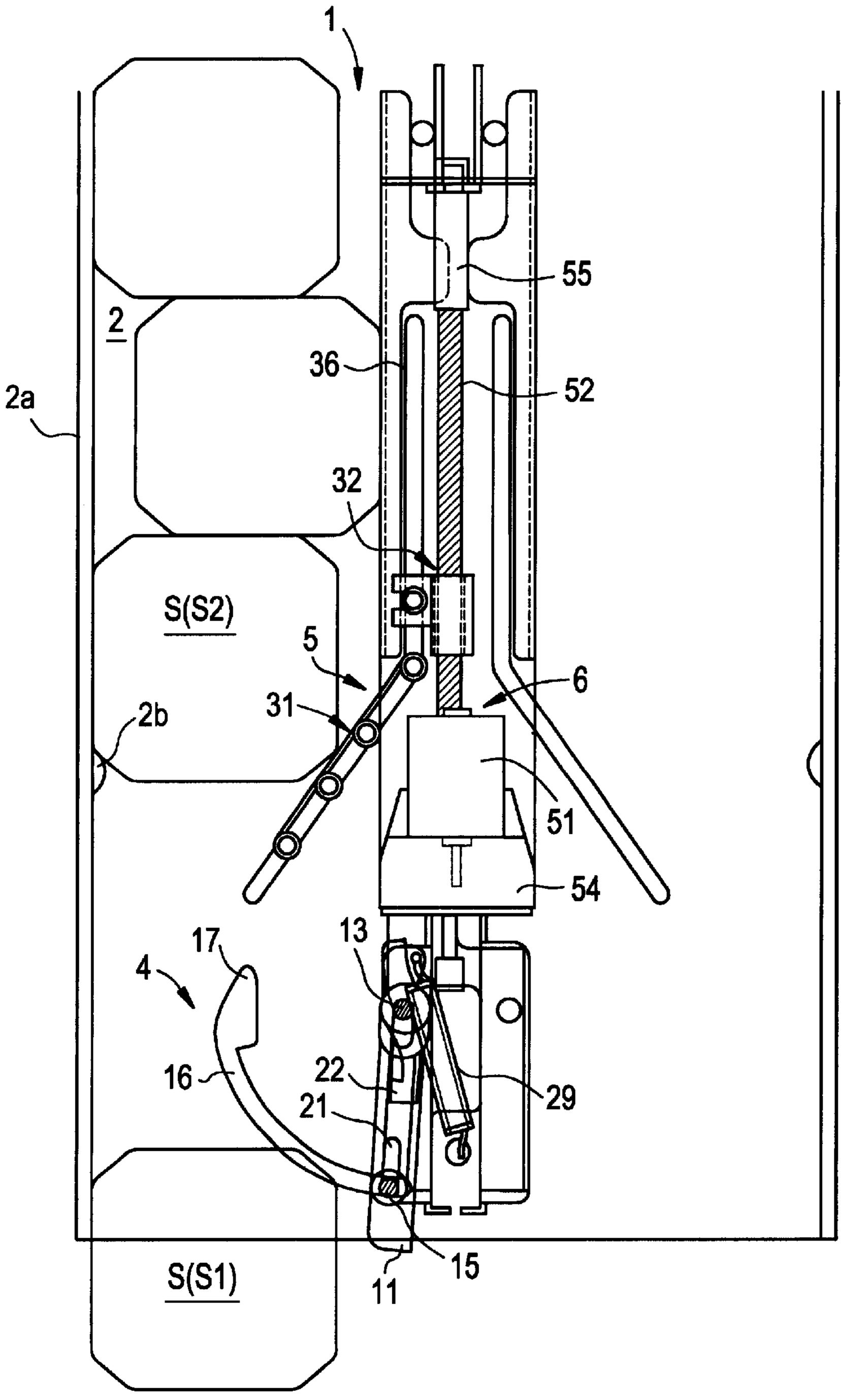


FIG. 22

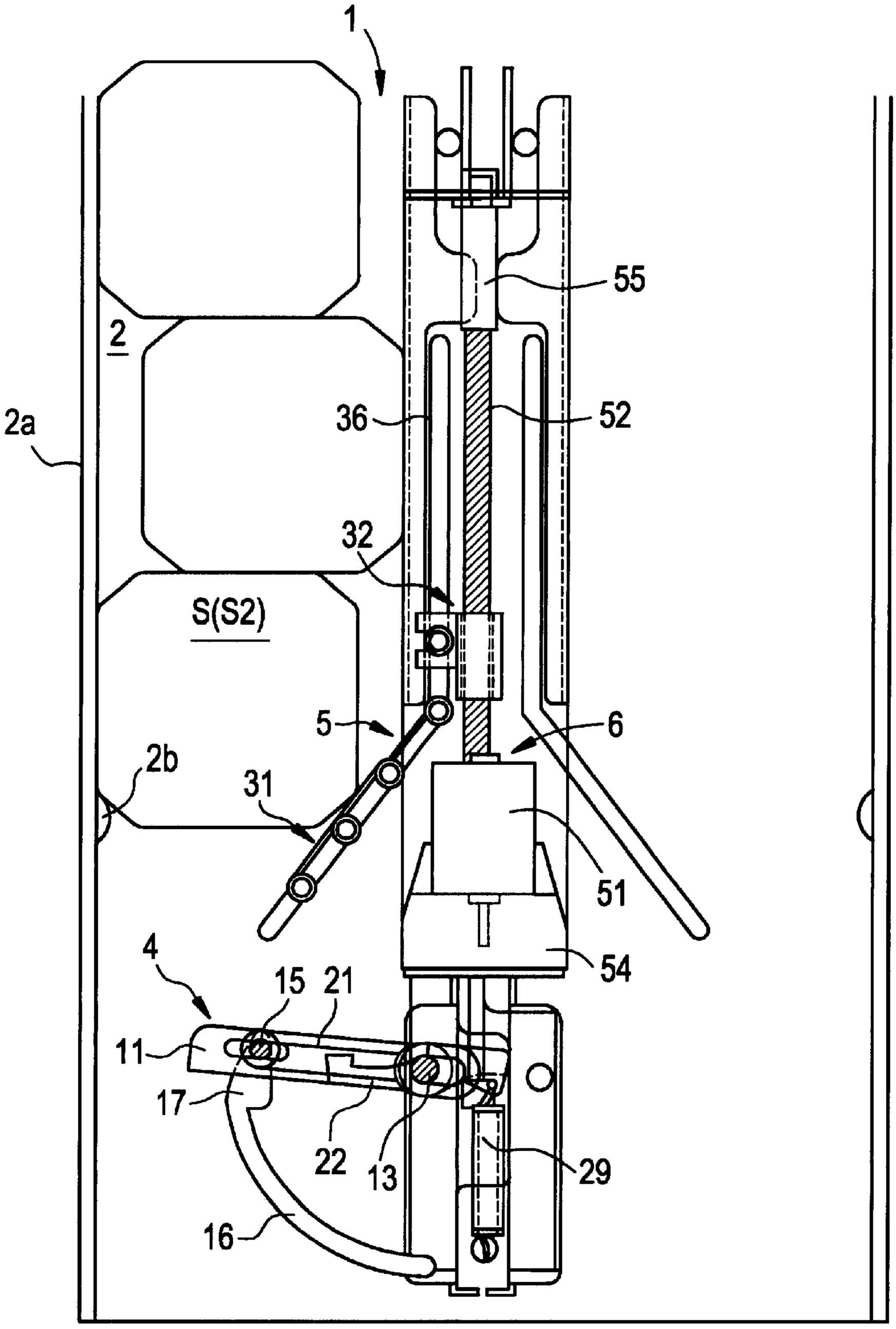


FIG. 23

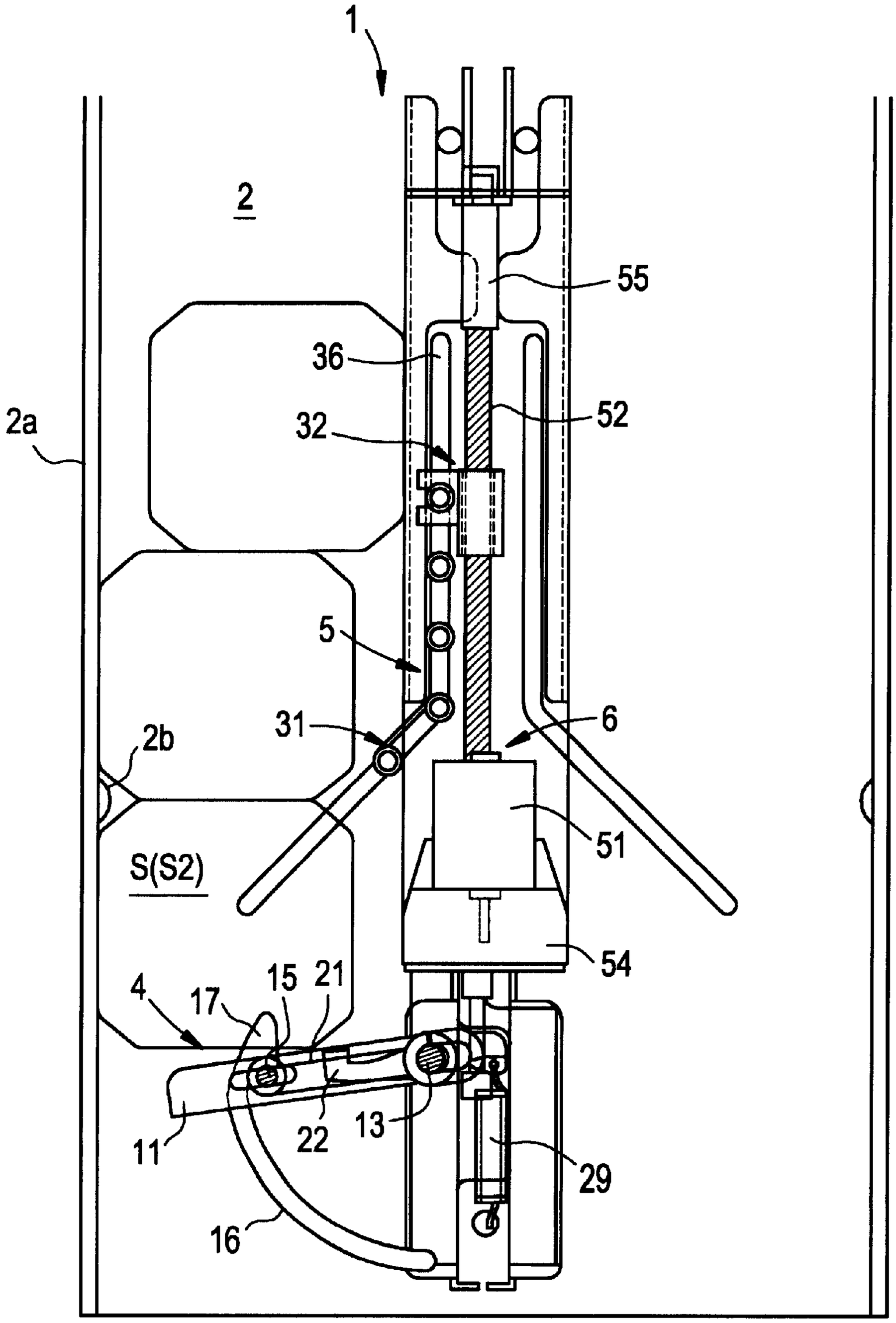


FIG. 24

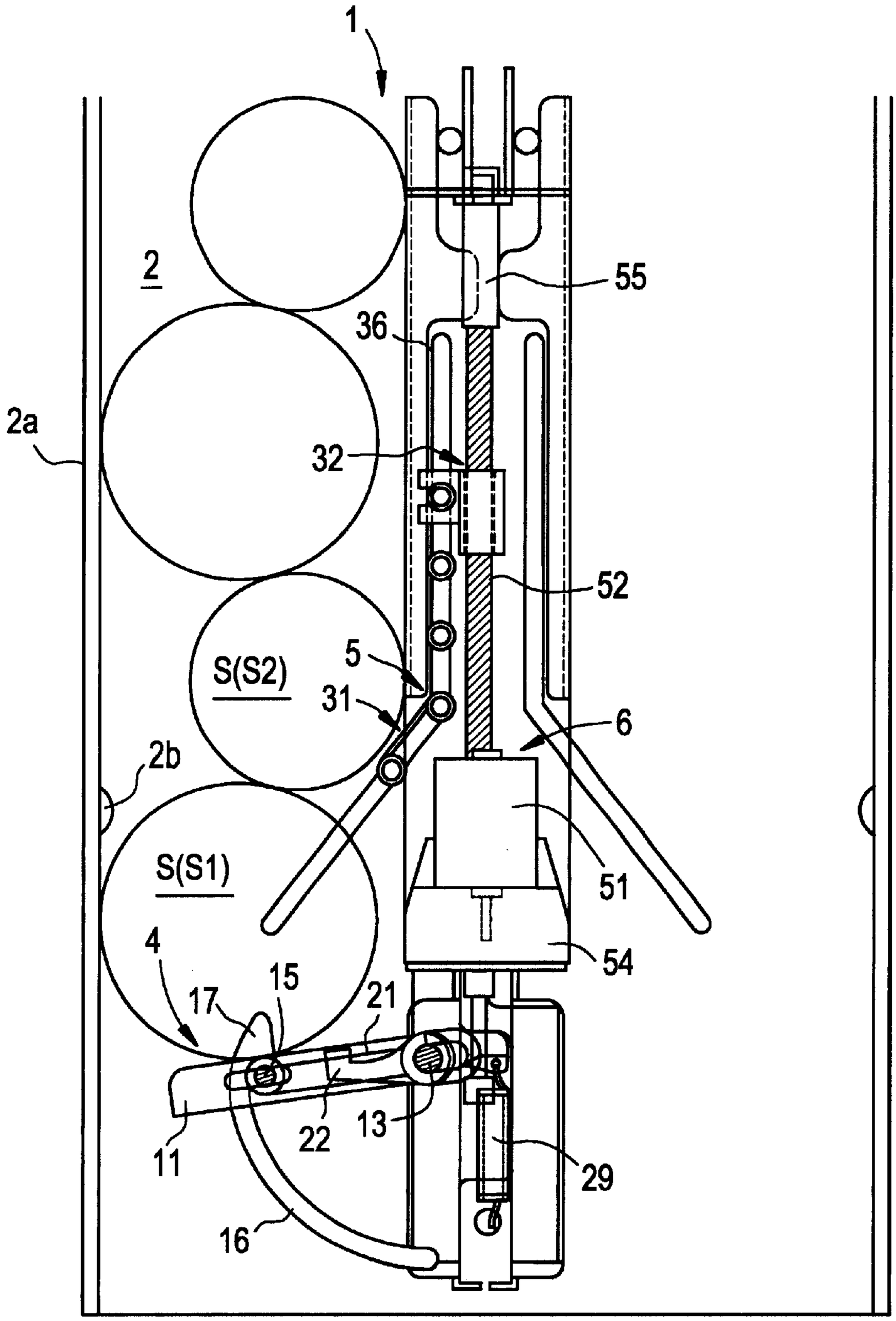


FIG. 25

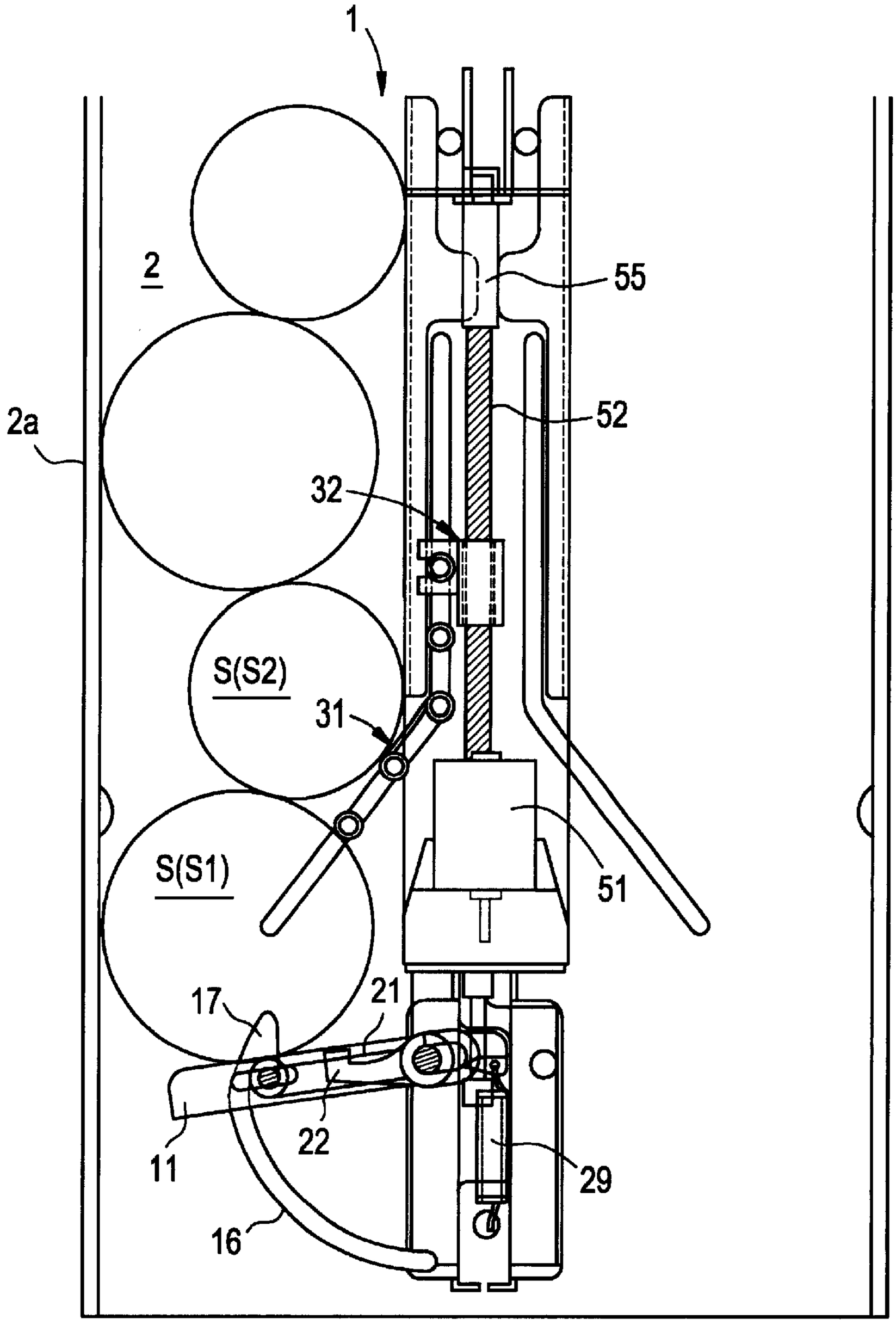


FIG. 26

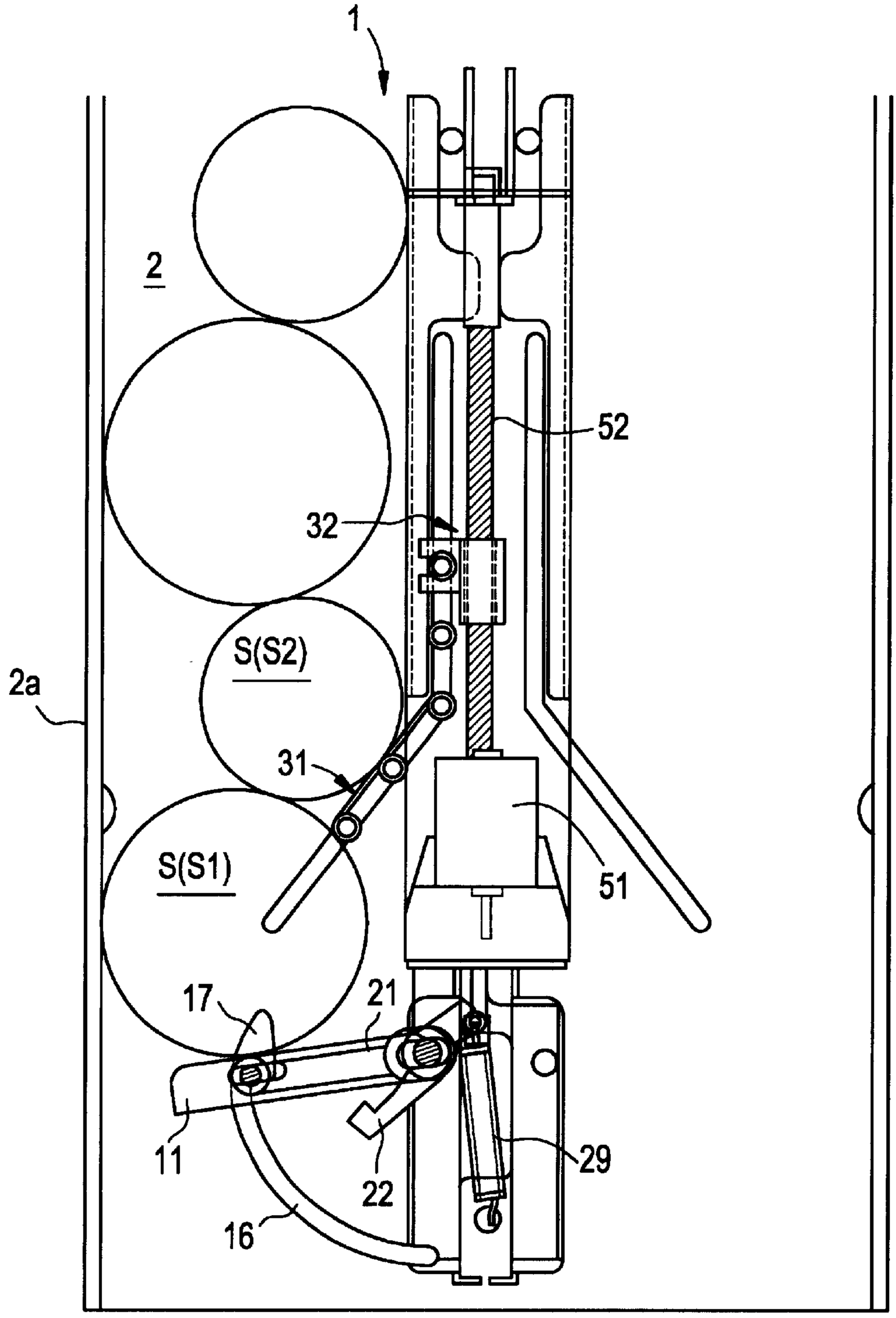


FIG. 27

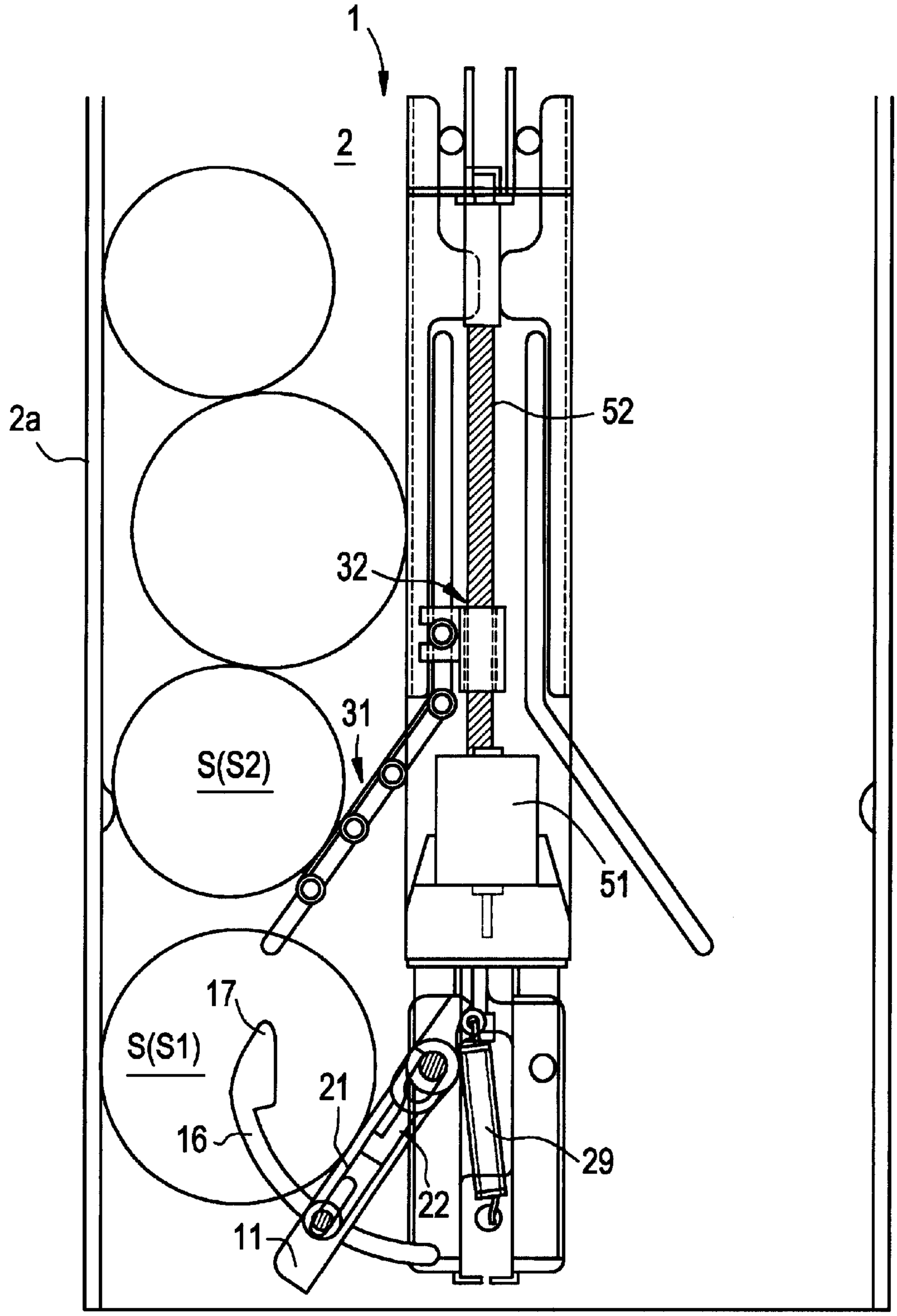


FIG. 28

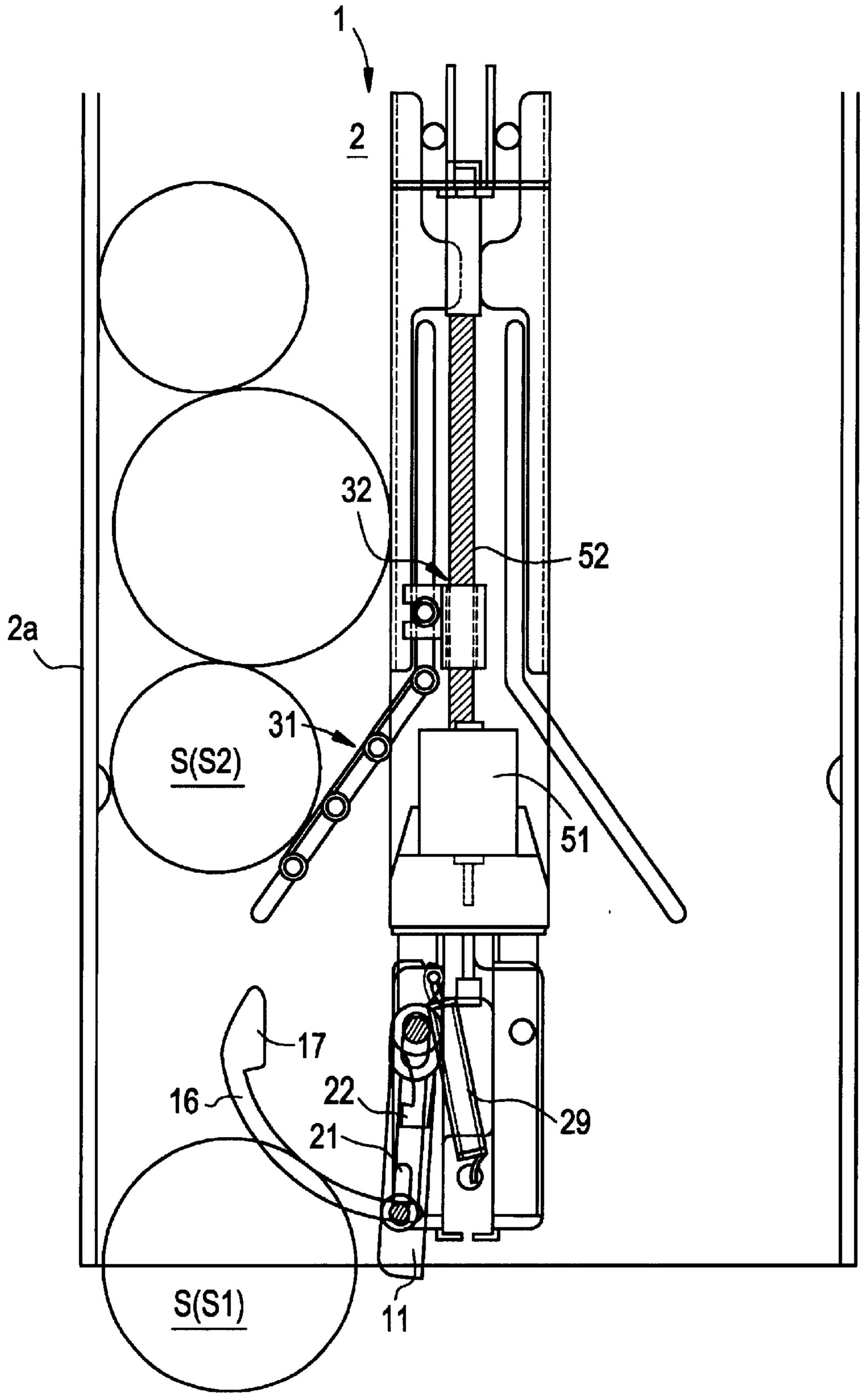


FIG. 29

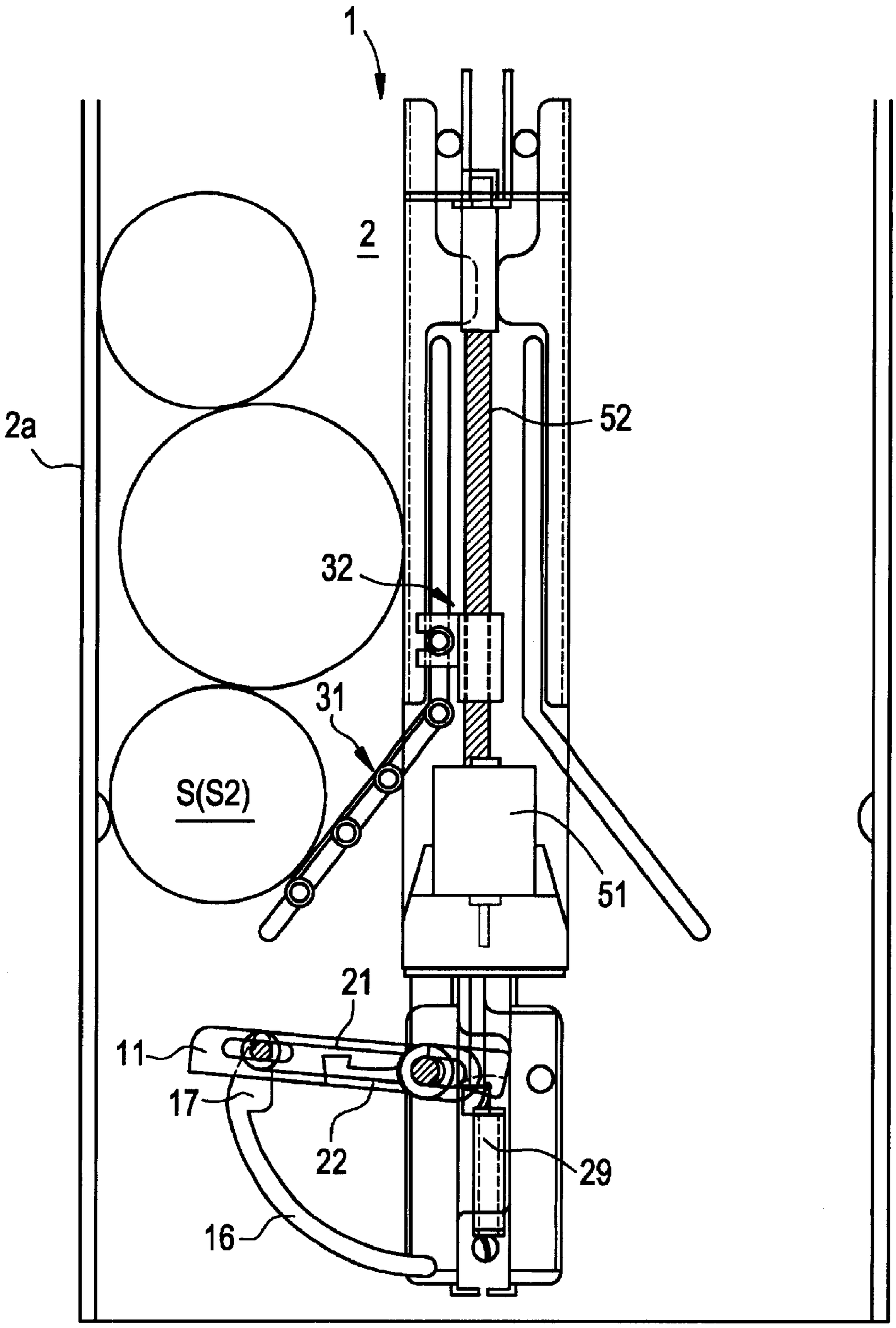
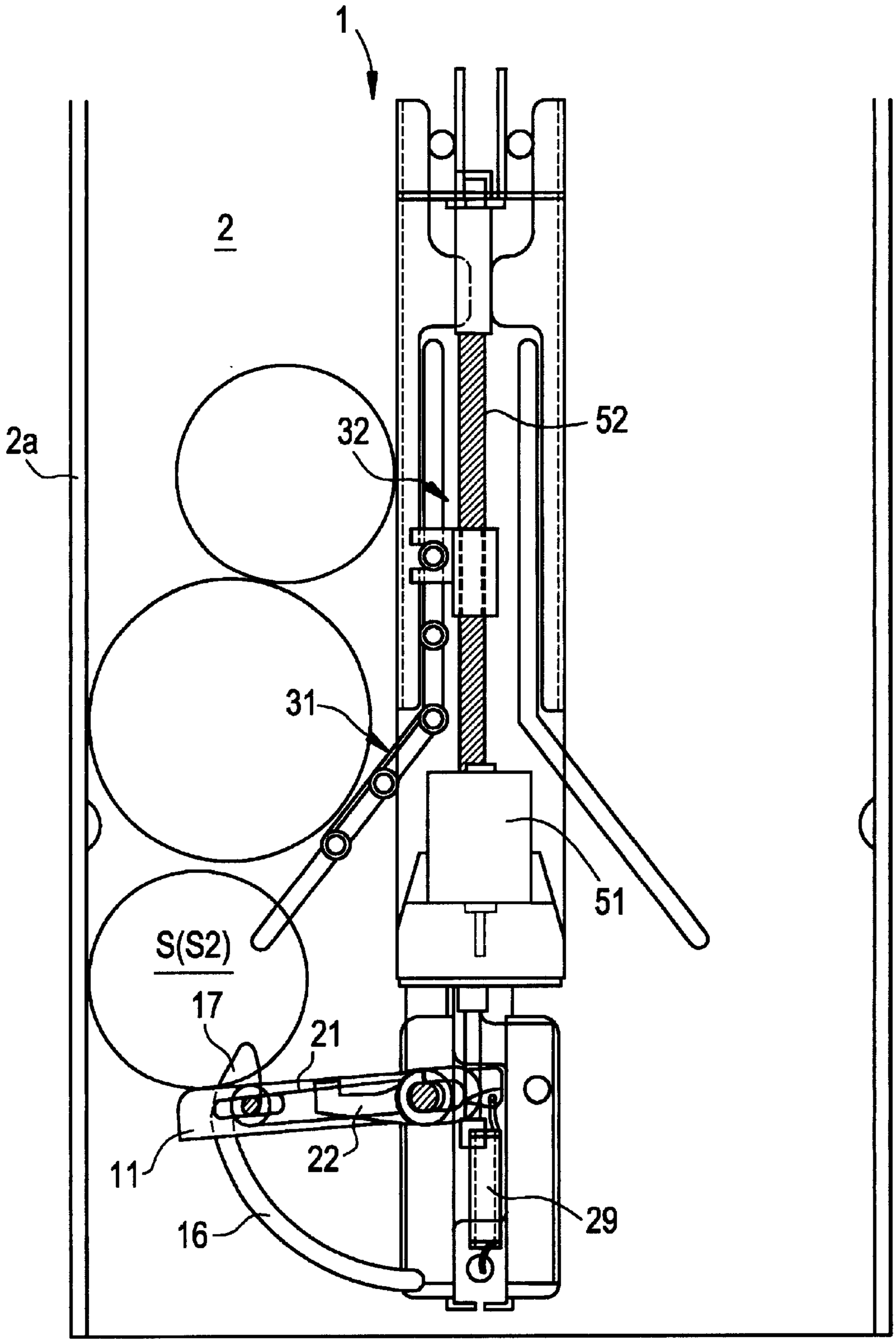


FIG. 30



PRODUCT DELIVERING DEVICE AND PRODUCT DELIVERING METHOD OF AUTOMATIC VENDING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a product delivering device and a product delivering method of an automatic vending machine for delivering a product located at the lowest position out of a plurality of products accommodated in a product column in a downward direction at the time of selling the product in the state in which the products placed in a horizontal direction are stacked in a vertical direction.

2. Description of the Related Art

Generally, in vending machines in which products such as canned drink products, PET bottle products are accommodated in a column (a product passage) in the state in which the products placed in a horizontal direction are stacked in a vertical direction, there is provided a product delivering device for delivering the product located at the lowest position in a downward direction at the time of selling the product out of the plurality of products accommodated in the lower end portion of the column. For example, such product delivering device comprises a stopper for supporting from the lower side the product to be sold next located immediately on the product to be sold at the time of selling the product while supporting from the lower side the product to be sold, and relieving the support of the product to be sold immediately after supporting the product to be sold next, and a solenoid for driving the stopper in this manner.

The column is defined with two passage walls having mutually a space and extending in a vertical direction. The product to be sold and the product to be sold next are supported with the stopper provided on one of the passage walls and the other passage wall so that the products are held in the column. This stopper is constituted in such a manner that the stopper is projected and recessed into the column by the rotation to support the product to be sold and the product to be sold next at the time of projecting into the column while, at the same time, the distance with one of the passage walls (hereinafter referred to as a passage width) can be set at a plurality of stages. Consequently, with the product delivering device having such stopper, the passage width can be increased and decreased in accordance with the size of the products to be sold so that products having various sizes can be delivered.

In the above product delivering device, a problem in that it is troublesome to set the stopper though it is possible to deliver products having various sizes. That is, in the case where the passage width is either decreased or increased in accordance with the products to be sold, the operator who accommodates the products must manually set the stopper itself at a desired position in accordance with the size of the products to be sold. in particular, in the case where a plurality of columns are arranged in a forward and a backward direction, the operator must extend his hand deep inside of the column at the time of setting the stopper of the column at the rear side, and his work becomes very troublesome. Furthermore, in order to appropriately deliver products having approximately a square configuration, and soft PET bottle products, it is necessary to appropriately attach an adapter and the work of attaching the adapter is also troublesome. On the contrary, in the case where the adapter becomes unnecessary along with the change in the product to be sold, the adapter must be detached from the stopper, and in addition, it is also troublesome to conserve and control the adapter after the detachment.

Furthermore, in the case where products having different sizes are accommodated in one column either by error or on purpose, products having large sizes are stuck in the product delivering device when the passage width is set to the size of products having smaller size with the result that a deliver error is generated. On the other hand, in the case where the passage width is set to the size of products having larger sizes, products having smaller sizes are delivered together with products having larger sizes with the result that there is a fear that larger number of products than necessary are delivered and sold.

Furthermore, in the method for relieving the support of the products immediately after supporting the product to be sold next while supporting with the stopper the product to be sold next located immediately on the product to be sold, it is necessary to prepare stoppers having sizes and configurations which conform to the configurations of the products to be handled such as the canned drink products and PET bottle products with the result that there is a problem in that the change of the products cannot be made easily because there arises a trouble of exchanging the stopper at the time of changing the products.

SUMMARY OF THE INVENTION

The present invention has been achieved with a view of the above problem, and an object of the present invention is to provide a product delivering device and a product delivering method of an automatic vending machine, the device and the method being capable of delivering only product to be sold with certitude at the time of selling the product irrespective of the size and the configuration of the product to be sold.

According to a first aspect of the present invention, a product delivering device of an automatic vending machine comprises: a stopper which projects into a product passage to support a product to be sold; an ejector which projects into the product passage to support a product to be sold next after the product to be sold; and control means for controlling a projection quantity to the product passage of the ejector; wherein the control means allows the ejector to project into the product passage to support product to be sold next upon receipt of a sales instruction, and at the same time, opens the stopper to deliver the product to be sold from the product passage to deliver the product to be sold from the product passage to the sales port thereby closing the product passage with the stopper after the delivery of the product to be sold while supplying the product to be sold next on the stopper by allowing the ejector to be recessed.

A second aspect of the present invention provides the product delivering device of the automatic vending machine according to the first aspect wherein the ejector projects into the product passage in the projection quantity in accordance with the size of the product to be sold accommodated in the product passage.

According to a third aspect of the present invention, the product delivering device of the automatic vending machine according to the first aspect comprises: a stopper which projects into a product passage to support a product to be sold: an ejector which projects into the product passage to support a product to be sold next after the product to be sold; and drive means having a drive shaft for driving the stopper and the ejector with the movement into an axial direction on the basis of the rotation movement; wherein the drive means drives the stopper and the ejector to deliver the product to be sold to a sales port by constraining the product to be sold next after the product to be sold by the rotation of the driving

shaft in a first direction, moves the stopper to the sales waiting position by rotating the driving shaft in a second direction and, at the same time, driving the stopper and the ejector so as to supply the product to be sold next to the sales waiting position from the product passage.

A fourth aspect of the invention provides the product delivering device of the automatic vending machine according to the third aspect wherein the stopper has a drive portion rotatably supported on a fixed system via a rotation shaft to receive a drive force from the drive means, and a rotation member formed of an opening and closing portion for opening and closing a product passage on the basis of the drive force.

A fifth aspect of the present invention provides the product delivering device of the automatic vending machine according to the third aspect wherein the ejector has a plate-like member which projects in an inclined manner into a product passage on the basis of the driving of the drive means, and a guide groove for guiding both ends of the plate-like member.

A sixth aspect of the present invention provides the product delivering device of the automatic vending machine according to the third aspect wherein the drive means has a drive motor which generates a rotation force for rotating the drive shaft in a first or a second direction, a first screw portion provided on the drive shaft for converting the rotation force into a to and fro movement into an axial direction of the drive shaft, a second screw portion engaging with the first screw portion and a joint portion engaged with the ejector to be supported on the drive shaft in such a manner that the joint portion can be moved to and fro.

According to a seventh aspect of the present invention, a product delivering device of an automatic vending machine for delivering a product located at the lowest position out of a plurality of products accommodated in a product passage in a downward direction at the time of selling the product in the state in which the plurality of products placed in a horizontal direction are stacked in a vertical direction, the device comprising: opening and closing means of the product passage movable between a closed position for closing the product passage so as to inhibit the delivery of the product to be sold, and an open position for opening the product passage so as to allow the delivery of the product, the means being capable of being driven toward the open position from the closed position with the weight of the product to be sold; allowing means for allowing the downward movement of the product to be sold located immediately on the product to be sold; means for supporting the product to be sold next movable between the allowing position for allowing the movement of the product to be sold next located immediately on the product to be sold and an inhibiting position for inhibiting the downward movement of the product to be sold next by supporting the product to be sold next in collaboration with the passage wall located opposite to the product passage, the inhibiting position being defined in contact with the upper a portion of the product to be sold; drive means for driving the means for supporting the product to be sold next between the inhibiting position and the allowing position; locking means for locking the product opening and closing means to the closed position; and a first unlocking means for unlocking the lock of the opening and closing means of the product passage by the locking means when the means for supporting the product to be sold next moves to the inhibiting position at the time of selling the product.

In this structure, the product to be sold is accommodated in the product passage in the state in which the delivery of the product is inhibited with the opening and closing means of the product passage locked at the above closed position with the locking means. At the time of selling the product, the means for supporting the product to be sold next moves from the allowed position to the product to be sold to come into contact with the above inhibiting position, namely, when the means for supporting the product to be sold next, the lock of the opening and closing means of the product passage means is driven from the closed position to the open position with the weight of the product to be sold with the result that the product to be sold is delivered from the product passage. on the other hand, the means for supporting the product to be sold next supports the product to be sold next in collaboration with the passage wall, so that only the product to be sold is delivered. In this case, the inhibiting position of the means for supporting the product to be sold next is defined by the product to be sold next coming into contact with the product to be sold next with the result that the inhibiting position is automatically and steplessly set in accordance with thee size and the configuration of the product. Consequently, in the above structure, only the product to be sold can be delivered at the time of selling the product irrespective of the size and the configuration of the product to be sold with the result that the flexibility of the product delivering device with respect to the product to be sold can be heightened.

An eighth aspect of the present invention provides the product delivering device of the automatic vending machine according to the seventh aspect wherein a projection portion having a height projecting to a predetermined length is provided on the passage wall, the height being approximately the same as the height at which the means for supporting the product to be sold next supports the product to be sold next.

In this structure, even when the product to be sold accommodated in the product passage has a square-shaped cross section and has four chambered corners as in the case of square-shaped bottles, the means for supporting the product to be sold next comes into contact with the chambered portion on the upper side of the product to be sold, and the two chambered portions on the lower side of the product to be sold can be supported with the means for supporting the product to be sold next and the projection portion. Consequently, with respect to not only canned drink products and PET bottle product having a circular cross section but also square-shaped PET products, only product to be sold can be delivered one by one with certitude without delivering a plurality of products at one time so that the flexability of the product delivering device can be further heightened.

A ninth aspect of the present invention provides the product delivering device of the automatic vending machine according to the seventh aspect or the eighth aspect wherein the opening and closing means of the product passage comprises: an opening and closing member which rotates on the base end portion between the closed position and the open position, the member having a long hole-like through hole extending in parallel with the rotation axial line and having a cross section extending in radial direction with respect to the center of the rotation; and a pair of guide portions provided opposite to each other with the opening and closing means located therebetween and extending in arc-like configuration centering on the rotation axis for guiding the opening and closing member between the closed position and the open position; and the locking means has a lock shaft being inserted loosely into the through hole of the opening and closing means, and, at the same time, having

both end portions projecting to the outside engaging the pair of guide portions respectively, the lock shaft being slidable in a direction of the through hole when the opening and closing member is located at the closed position, an anchor portion provided respectively on the pair of guide portions so as to be projected in a radial direction with respect to the center of rotation to anchor the lock shaft, and a lock mechanism for locking the lock shaft into the anchor portion.

In this structure. the opening and closing means of the product passage rotates centering on the base end portion while being guided to the pair of guide portions via the lock shaft.

As a consequence, the opening and closing member smoothly rotates between the closed position and the open position at the time of selling the product so that the product to be sold can be delivered with certitude. Furthermore, when the opening and closing member is located at the closed position, the lock shaft anchors the anchor portion by sliding through the through hole of the opening and closing member in a long hole direction with the result that the lock shaft is locked in the anchor portion with the lock mechanism. That is, the lock shaft is double locked to the anchor portion with the lock mechanism. Thus, the detachment of the lock shaft from the anchor portion of the guide portions by the collision to the opening and closing member because of the coming down of the product at the time of refilling of the product or by tampering can be prevented with certitude and the lock of the opening and closing member at the closed position can be held with certitude.

A tenth aspect of the present invention provides the product delivering device according to the ninth aspect wherein through hole of the opening and closing member is provided on the end portion of the opening and closing member.

In this structure, since the opening and closing member can be locked at the end portion thereof via the lock shaft which is inserted into the through hole loosely, the moment acting on the opening and closing member with the weight of the product to be sold can be minimized as compared with the case in which the opening and closing member is locked at a position close to the base end portion. Thus, the opening and closing member at the closed position can be locked with certitude in a stable state.

According to an eleventh aspect of the present invention provides the product delivering device of the automatic vending machine according to the ninth or the tenth aspect wherein the lock mechanism is arranged between a pair of guide portions.

In this structure, since the lock mechanism is arranged between the pair of guide portions, the width of the product delivering device in the direction of the rotation axis of the opening and closing member, namely, the width of the product delivering device in the right and the left direction of the automatic vending machine can be reduced. As a consequence, the product delivering device can be constituted in a compact size, the device can be provided in a limited space and the width of the automatic vending machine in the right and the left direction can be reduced.

According to a twelfth aspect of the present invention provides the product delivering device of the automatic vending machine according to either the ninth aspect or the eleventh a aspect wherein the lock member comprises: a slide member attached with the lock shaft and constituted slidably between the lock position at which the lock shaft anchors the anchor portion of the pair of guide portions, and the unlock position at which the lock shaft is detached from the anchor portion; the slide member having an engaging portion; and a lock member detachably constituted in the engaging portion of the slide member to lock the slide member at the lock position by engaging the engaging portion of the slide member when the slide member is located at the lock position.

In this structure, when the slide member slidable between the lock position and the lock relief position is located at the lock position, the slide member is locked at the lock position by the engagement of the lock member into the engaging portion of the slide member. With such slide member and the lock member, the lock mechanism can be easily realized for double locking the opening and closing member located at the closed position.

A thirteenth aspect of the present invention provides the product delivering device of the automatic vending machine according to the twelfth aspect wherein the lock member is constituted rotatably between the engaging position for engaging the engaging portion of the slide member, and the detachment position for detaching from the engaging portion, and a pressing portion for sliding the slide member from the lock position to the unlock position by pressing the slide member when the lock member is rotated from the engaging position to the detachment position.

In this structure, when the lock member located at the engaging position is rotated toward the detachment position, the slide member is pressed with the pressing portion of the slide member with the result that the slide member slides from the lock position to the unlock position. Consequently, the lock shaft is detached from the anchor portion of the guide portion, so that the lock of the opening and closing member at the closed position by the lock shaft can be unlocked. Thus, with a single lock member, both the locking and the unlocking of the opening and closing member at the closed position with the lock shaft can be conducted.

A fourteenth aspect of the present invention provides the product delivering device of the automatic vending machine according to the thirteenth aspect wherein the lock mechanism has a first energizing means for energizing the lock member to be rotated from the detachment position to the engaging position, so that the lock member is rotated from the open position to the closed position by pressing the opening and closing member when the opening and closing member is located at the open position and is rotated from the detachment position to the engaging position with the first energizing means.

In this structure, the opening and closing member which is rotated from the closed position to the open position with the weight of the product to be sold is pressed against the lock member by the rotation of the lock member located at the detachment position from the detachment position from the detachment position to the engaging position with the first energizing means, so that the lock member is pressed thereby rotating the lock member from the open position to the closed position. Consequently, the opening and closing member which is rotated to the open position can be brought back to the closed position with certitude with the lock member. On the other hand, the lock of the opening and closing member at the closed position is unlocked, the energizing force of the first energizing means ceases to be transmitted to the opening and closing member because the lock member is set to the state in which the lock member is not in contact with the opening and closing member. Therefore, when the lock of the opening and closing member at the closed position is unlocked, the opening and closing

member can be easily rotated with the weight of the product to be sold even when the product to be sold is light so that the product to be sold can be delivered with certitude.

A fifteenth aspect of the present invention provides the product delivering device of the automatic vending machine according to the thirteenth and the fourteenth aspect wherein means for supporting the product to be sold next has a member for supporting the product to be sold next, the member being constituted slidably between the allowing position and the inhibiting position and a connection portion having a female screw and being movable in a vertical direction for connecting the means for supporting the product to be sold next to the drive means; and the drive means has a drive source and a drive shaft having a male screw on the surface thereof which is constituted in such a manner that the drive shaft extends in a vertical direction and is movably provided in a vertical direction to be rotated and driven in a predetermined direction around an axial line with a drive source with the result that the drive shaft moves the member for supporting the product to be sold next toward the inhibiting position around an axial line with the drive source via a connection member which moves in a downward direction, and the drive shaft is further rotated and moved in a predetermined direction with the drive source after the means for supporting the product to be sold next comes into contact with the product to be sold so that the drive shaft is moved in an upward direction; wherein the first unlocking means has an unlocking member provided on the lower end of the drive shaft, and at the same time, connected to the lock member, and rotates the lock member from the engaging position to the detachment position along with an upward movement of the drive shaft.

In this structure, since the member for supporting the product to be sold next of the means for supporting the product to be sold next is connected to the drive shaft having a male screw which engages the female screw, this drive shaft is rotated and driven around the axial line with the drive source at the time of selling the product. Then, the connection member moves in a vertical direction with the result that the product to be sold next slides between the allowing position and the inhibiting position. When the drive shaft is rotated and driven in a predetermined direction at the time of selling the product, the connection member moves in a downward direction so that the member for supporting the product to be sold next slides toward the inhibiting position along with this. When the product to be sold next comes into contact with the product to be sold next, the member for supporting the product to be sold next is suspended because the member cannot be slided any more. Along with this, the connection member which has moved in a downward direction is also suspended. After the member for supporting the product to be sold next has come into contact with the product to be sold next, the drive shaft moves in an upward direction with respect to the suspended connection member. After the member for supporting the product to be sold next comes into contact with the product to be sold next, the drive shaft moves in an upward direction. Along with this, the first unlocking member provided on the lower end portion of the drive shaft is rotated toward from the engaging position to the detachment position.

Consequently, the product delivering device can be easily realized for unlocking the opening and closing means of the product passage when the means for supporting the product to be sold next comes into contact with the means for supporting the product to be sold next with the drive means and the first unlocking means.

A sixteenth aspect of the present invention provides the product delivering device of the automatic vending machine according to the fifteenth aspect where in the drive means further has a second energizing means for energizing the drive shaft in a downward direction, wherein the second energizing means is further rotated and driven in a predetermined direction with the drive force after the member for supporting the product to be sold next comes into contact with the sales product so that the second energizing means is compressed or pulled with the drive shaft which moves in an upward direction and the product to be sold is delivered with the result that the drive shaft is driven in a downward direction with a return force when the contact of the product to be sold with the member for supporting the product to be sold next is released.

In this structure, when the drive shaft is further rotated and driven in the predetermined direction after the member for supporting the product to be sold next comes into contact with the sales product to reach the inhibiting position, the drive shaft moves upward when the drive shaft is further rotated and driven in the predetermined direction with the result that the second energizing means is compressed and pulled. Then the sales product is delivered so that the drive shaft is driven downward with the return force of the second energizing means at the same time when the contact of the member for supporting the product to be sold next to the sales product is released. Then, the connection member connected to the drive shaft moves in a downward direction so that the member for supporting the product to be sold next further slides toward the side of the passage wall over the inhibition position. Consequently, for example, in the case here products having different sizes are accommodated in the product passage either by mistake or on purpose, the product to be sold next can be supported by the sliding of the member for supporting the product to be sold next toward the side of the passage wall over the inhibiting position. As a consequence, even in the above case, only the product to be sold is delivered thereby preventing the delivery and selling of larger number of products.

According to a seventeenth aspect of the present invention, the product delivering device of the automatic vending machine according to a seventh through sixteenth aspect further comprises: instruction means which is operated for instructing the delivering of all the product accommodated in the product passage at one time; and second unlocking means for unlocking the opening and closing means of the locking means.

In this structure, when the above instruction means is operated by the operator who refills the products in the automatic vending machine, the opening and closing means of the product passage by the locking means in unlocked with the second unlocking means. Consequently, in the case where a plurality of products are accommodated in the product passage, and the products are exchanged by other products, all the products accommodated in the product passage can be delivered at one time in a package by the operation of the instruction means with the result that the exchange work of the products can be conducted in a short time.

According to an eighteenth aspect of the present invention, the method for delivering the products in the vending machine comprises: accommodating product to be sold in the product passage; and delivering the product to be sold in the state in which the product to be sold next which is to be sold immediately after the product to be sold is supported in the product passage.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side sectional view showing a product delivering device of an automatic vending machine according to one embodiment of the present invention.

FIG. **2** is a side sectional view showing a state in which the product delivering device is arranged back to back to each other, and the products are accommodated in the product passage.

FIG. **3** is a front view showing the product delivering device.

FIG. **4** is a plan view showing the product delivering device.

FIG. **5** is a broken perspective view showing the product delivering device.

FIG. **6** is a broken perspective view showing a main body of the stopper,

FIG. **7**(*a*) is a side view showing them main body of the stopper,

FIG. **7**(*b*) is a side view showing a slide member, and FIG. **7**(*c*) is a side view showing a lock member, and FIG. **7**(*d*) is a side sectional view showing an assemblage of these members.

FIG. **8** is a side sectional view showing a series of an operation from the unlocking of the main member of the stopper which is locked until relocking of the main body of the stopper.

FIG. **9** is a side sectional view showing a product delivering device for explaining the delivering of a thin canned product, the view showing the state before the main body of the ejector begins to move.

FIG. **10** is a side sectional view following FIG. **9** and showing the product delivering device, the view showing the state immediately after the main body of the ejector comes into contact with the product to be sold.

FIG. **11** is a side sectional view following FIG. **10** and showing the product delivering device, the view showing the state in which the lock member is detached from the slide member.

FIG. **12** is a side sectional view following FIG. **11** and showing the product delivering device, the view showing the state in which the main body of the stopper is rotated toward the open position.

FIG. **13** is a side sectional view following FIG. **12** and shoring a product delivering device, the view showing the state in which the main body of the stopper reaches the open position, and the product to be sold is delivered.

FIG. **14** is a side sectional view following FIG. **13** and showing the product deliver device, the view showing a state in which the main body of the stopper is rotated to the closed position of the main body of the stopper

FIG. **15** is a side sectional view following FIG. **14** and showing the product delivering device, the view showing the state in which the main body of the stopper is rotated to the closed position and the stopper is locked with the coming down of the product to be sold next which has been supported with the main body of the ejector.

FIG. **16** is a side sectional view showing the product delivering device, the view showing the state before the main body of the ejector begins to move.

FIG. **17** is a side sectional view showing the product delivering device for explaining the delivering of a square shaped PET bottle, the view showing the state before the main body of the ejector begins to move.

FIG. **18** is a side sectional view following FIG. **17** and showing the product delivering device, the view showing the state in which the main body of the ejector, the view showing the state immediately after the main body of the ejector comes into contact with the product to be sold.

FIG. **19** is a side sectional view following FIG. **18** and showing the product delivering device, the view showing the state in which the lock member is detached from the slide member.

FIG. **20** is a side sectional view following FIG. **19** and showing the product delivering device, the view showing the state in which the main body of the stopper is rotated to the open position of the main body of the stopper.

FIG. **21** is a side sectional view following FIG. **20** and showing the product delivering device, the view showing the state in which the main body of the stopper reaches the open position, and the product to be sold is delivered.

FIG. **22** is a side sectional view following FIG. **21** and showing the product delivering device, the view showing the state in which the upper end is rotated to the guide groove.

FIG. **23** is a side sectional view following FIG. **22** and showing the product delivering device, the view showing the state in which the main body of the stopper is rotated to the closed position and locked by the coming down of the product to be sold next which is supported by the main body of the ejector.

FIG. **24** is a side sectional view showing the product delivering device for explaining the delivery of the product from the product passage in which large canned products and thin canned products are accommodated in a mixed manner, the view showing the state before the main body of the ejector begins to move.

FIG. **25** is a side sectional view following FIG. **24** and showing the product delivering device, the view showing the state immediately after the main body of the ejector comes into contact with the thick canned product to be sold.

FIG. **26** is a side sectional view following FIG. **25** and showing the state in which the lock member is detached from the slide member.

FIG. **27** is a side sectional view following FIG. **26** and showing the product, the view showing the state in which the main body of the stopper is rotated to the open position.

FIG. **28** is a side sectional view following FIG. **27** and showing the side sectional view of the product delivering device, the view showing the state in which the main body of the stopper reaches the open position and thick canned product to be sold is delivered.

FIG. **29** is a side sectional view following FIG. **28** and showing the product delivering device, the view showing the state in which main body of the stopper is rotated to the upper limit position of the guide groove.

FIG. **30** is a side sectional view following FIG. **29** and showing the state in which the main body of the stopper is rotated to the closed position and is locked by the coming down of the product to be sold next supported on the main body of the ejector onto the main body of the stopper.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be explained in detail by referring to the drawings hereinafter. FIG. **1** is a view showing a product delivering device of an automatic vending machine according to one embodiment of the present invention. This product delivering device **1** is assembled in an automatic vending machine for selling, for example, canned drink products and PET bottle products so that only the product to be sold located on the lowest position is delivered in a downward direction at the time of selling the product out of a plurality of products accommodated in the state in which the products placed in a horizontal

direction are stacked in a vertical direction. Furthermore, normally as shown in FIG. **2**, the product delivering device **1** is arranged at the lower end portion of a partition wall (not shown) of two product passages **2** and **2** located at the front and the rear position extending in the vertical directions (in the right and the left direction in FIG. **2**) in the state in which the two product passages are located back to back to each other. At the time of selling the product, each of the product delivering devices **1** is independently operated to deliver the product S to be sold in each of the product passages. Incidentally, in the forgoing explanation, the products to be sold next located immediately on the product to be sold are respectively denoted by reference numerals S1 and S2 out of the product S accommodated in the product passage **2**.

The product delivering device **1**, as shown in FIGS. **1** through **5**, comprises: a stopper **4** opening and closing means of a product passage) for delivering in a downward direction the product S1 to be sold by allowing the product to be sold accommodated in the product passage **2** to come down by opening and closing the lower end portion. of the product passage **2** at the time of selling the product; an ejector **5** (means for supporting the product to be sold next) for supporting the product to be sold next in collaboration with the wall of the passage **2***a* projecting to the product passage and located opposite to the product passage **2**; wherein the stopper **4** and the ejector **5** are assembled between the pair of side plates **7** and **7** having a predetermined configuration located opposite to each other in the right and the left direction as shown in FIGS. **4** and **5**.

The stopper **4** comprises a thick plate having a planar configuration formed approximately in a square configuration, and the stopper **4** has a main body **11** (an opening and closing member) which is rotatable around the base end portion. The main body **11** of the stopper is locked to the closed position described later with the locking means **12** assembled in the main body of the stopper.

The main body **11** of the stopper is rotatably attached on the side plate via the rotation shaft **13** attached on the base end portion. The main body **11** of the stopper is rotatably attached on the side plates **7** and **7** via the rotation shaft **13** attached on the base end portion so that the main body **11** of the stopper can be rotated between the closed position (see FIG. **1** and the like) for closing the product passage **2** so as to inhibit the delivery of the product to be sold at the time of selling the product and the open position (see FIGS. **13**, **21** and **28**) for opening the product passage **2** so as to allow the delivery of the product S1 to be sold at the time of selling the product. Furthermore, at a position close to the end portion of the main body **11** of the stopper, there is provided a long hole-like through hole **14** extending in parallel with the axial line (hereinafter referred to as the rotation axial line) of the rotation shaft **13** and having a cross section extending in a radial direction with respect to the center of the rotation, Into this through hole **14**, the lock shaft **15** is inserted loosely for locking the main body **11** of the stopper at the closed position. The lock shaft **15** is constituted in such a manner that the shaft **15** can be slided in a direction of the long hole of the through hole **14**, and both ends of the lock shaft **15** projecting to the outside from the through hole **14** are inserted loosely into the guide groove **16** (the guide portion) having a predetermined configuration which is formed on each of the side plates **7**. Each of the guide grooves **16** is formed so as to extend in an approximately ¼ arc-like configuration. At the upper end thereof, a shaft anchor groove **17** is formed for guiding the lock shaft **15** to allow the lock shaft **15** to be slided and anchored to the base end portion of the main body **11** of the stopper.

The main body **11** of the stopper constituted in this manner is smoothly rotated between the closed position and the open position while being guided to both guide grooves **16** and **16** via the lock shaft **15**. The lock shaft **15** is locked with certitude to the closed position by the anchoring of the lock shaft **17** to each of the anchor groove **16** of the lock shaft.

As described above, the locking means is provided for locking the main body **11** of the stopper to the closed position, and the main body **11** of the stopper comprises the lock shaft **15**, the shaft anchor groove **17** and a lock mechanism **18** assembled in the main body **11** of the stopper for locking the lock shaft **15** to the shaft anchor groove **17**. As shown in FIG. **5** or **8**(*a*), the shaft anchor groove **17** is formed approximately in a right angle triangular configuration with an anchor portion connected to the inside guide surface **16***a* of the guide groove **16** to project horizontally toward the side of the rotation shaft **13**, a vertical guide portion **17***b* connected to the end of the anchor portion **17***a* and extending approximately vertically upward, and an inclined guide portion **17***c* connected in an inclined manner to the upper end of the vertical guide portion **17***b* and the outside guide surface **16***b* of the guide groove **16**. When the main body **11** of the stopper is rotated from the open position toward the closed position, the lock shaft **15** is guided with the inclined guide portion **17***b* to be anchored to the anchor portion **17***a* so that the main body **11** of the stopper is locked to the closed position.

As shown in FIG. **6** and FIG. **7**, the lock mechanism **18** is accommodated in the planar opening **11***a* having approximately a square configuration of the main body **11** of the stopper, and has a slide member **21** slidable between the lock position and the unlock position described later, and a lock member **22** for locking the slide member **21** to the lock position and allowing the slide member **21** to slide toward the unlock position at the time of selling the product.

The slide member **21** has a pair of side wall portions **23** and **23** extending in parallel to each other with a space mutually to each other, an upper wall portion **24** connecting approximately horizontally between the upper end portions of the side wall portions **23** and **23**, and a lower wall portion **25** connecting between the lower end portions of the side wall portions **23** and **23**. On the end portion of the side wall portions **23** and **23**, the lock shaft **15** is penetrated and provided, and at the same time, on the base end portion on the opposite side, long holes **23***a* and **23***a* are formed which extends in the extending direction of the side wall portions. The upper wall portions **24** are formed in an upward direction of the long holes **23***a*, and is formed to extend in a predetermined length toward the end portion of the slide member **21** approximately from the intermediate portion in the long hole direction of the long holes **23***a* and **23***a*. Furthermore, on the end of the upper wall portion **24**, an open engaging portion **24***a* to which the engaging projection portion **27***a* of the lock member **22** described later is formed. On the other hand, the lower wall portion **25** is constituted in such a manner that the lower end portion extends in a downward direction from the end of the upper wall portion **24** and is bent at right angle to extend toward the end portion of the slide member **21**.

The slide member **21** which is constituted in this manner is such that the lock shaft **15** at the end portion is inserted loosely into the through hole of the main body **11** of the stopper, and the rotation shaft **13** is inserted loosely into the long holes **23***a* and **23***a* of the base end portion in the state in which the slide member **21** is accommodated in the opening **11***a* of the main body **11** of the stopper as shown in

FIG. **7**(*d*). Then, the slide member **21** can be slided between the lock position (see FIG. **8**(*a*)) at which the lock shaft **15** anchors the anchor portion **17***a* of the shaft anchor groove **17** and the unlock position (see FIG. **8**(*d*)) at which the lock shaft **15** is detached from the anchor portion **17***a*.

On the other hand, the lock member **22** has a hole portion **26** in which the rotation shaft **13** can be inserted loosely, a lock portion **27** in which the end portion (hereinafter referred to as an engaging projection portion) **27***a* and a connection portion **28** extending in a direction opposite to the lock portion **27** with a hole portion **26** therebetween, and connecting to a drive shaft **52** of the drive mechanism **6** described later and delivery shaft **53**. This lock member **22** becomes rotatable between the engagement position (see FIG. **7**(*d*) and FIG. **8**(*a*)) at which the engaging projection portion **24***a* of the lock member **22** engages the engaging portion **24***a* from the lower side and the detachment position at which the projection portion **27***a* of the lock member **22** is detached from the engaging portion **24***a* by allowing the lock member **22** to be assembled into the main body **11** of the stopper in the state in which the rotation shaft **13** is inserted loosely into the hole portion **28**. On the connection portion **28**, two notches **28***a* and **28***a* are formed which extend in parallel with each other toward the hole portion **26**. The lower end portions of the drive shaft **52** and the delivery shaft **53** are inserted loosely respectively into these notches **28***a* and **28***a*.

Furthermore, the notches **26***a* and **28***a* of the connection portion **28** and the end portion **28***b* (pressed portion) on the opposite side are formed at a position one step higher than the lock portion **27**. Consequently, in addition to the slide member **21**, the lock member **22** is assembled in the main body **11** of the stopper. When the lock member **22** is positioned at the engaging position, as shown in FIG. **7**(*d*), the end portion **28***b* of the connection portion **28** comes close to the end portion of the upper wall portion **24** of the slide member **21**. Furthermore, on the side portion of the connection portion **28**, a pull spring **29** (a first energizing means) is attached on the side portion of the connection portion **28**. This pull spring **29** is energized so as to rotate the lock member **22** in a clockwise direction in FIG. **7**. With this pull spring **29**, the lock member **22** is set to the state in which the lock member **22** is energized to the engaging position at all times.

The lock member **22** constituted in this manner is rotated to the detachment position from the engaging position in a counterclockwise direction in FIG. **7** by the pulling up of the connection portion **28** either with the drive shaft **52** or the delivery shaft **53**.

Incidentally, on the main body **11** of the stopper, an upper lid **11***b* for opening and closing the opening **11***a* is detachably attached. When the upper lid **11***b* is attached thereon, the upper lid **11***b* and the main body **11** of the stopper form one surface.

Here, by referring to FIG. **8**, the locking and unlocking of the main body **11** of the stopper by the locking means will be explained. As shown in FIG. **8**(*a*), the slide member **21** is located at the lock position at the sales waiting time so as to lock the slide member **21** to the lock position. In this case, the lock shaft **15** of the slide member **21** is supported to the anchor portion **17***a* from the lower side with the result that the main body **11** of the stopper is locked to the closed position in the state in which the product to be sold is supported from the lower side.

In this state, when the connection portion **28** of the lock member **22** is pulled up either with the connection portion **28** or a drive shaft **52**, the lock member **22** is rotated in a counterclockwise direction toward the detachment position against the pull spring **29**. Thus, as shown in FIG. **8**(*b*), the engaging projection portion **27***a* of the lock member **22** is detached from the engaging portion **24***a* of the slide member **21**, and, at the same time, the end portion **28***b* of the connection portion **28** of the lock member **22** presses the end portion of the upper wall portion **24** of the **24** of the slide member toward the end of the main body **11** of the stopper. Then, the slide member **21** at the lock position gradually slides toward the unlock position. When the lock member **22** further rotates to press the slide member **21** and the slide member **21** reaches the unlock position as shown in FIG. **8**(*d*), the lock shaft **15** is completely detached from the anchor portion **17***a* of the shaft anchor groove **17**. Then, as shown in FIG. **8**(*b*), the main body **11** of the stopper is rotated and driven toward the open position while being guided with the guide groove **16** via the lock shaft **15**. When the main body **11** of the stopper reaches the open position, the product S**1** to be sold comes down and is delivered from the product passage.

After that, when the drive shaft **52** or the delivery shaft **53** which pulls up the connection portion **28** of the lock member **22** releases the pull-up of the connection portion **28**, the lock member **22** is rotated and driven in the clockwise direction with the return force of the pull spring **29**. Then, the engaging projection portion **27***a* of the lock member **22** presses up the upper wall portion **24** of the slide member **21** from the lower side with the result that, as shown in FIG. **8**(*f*). the main body **11** of the stopper is rotated in a clockwise direction toward the closed position.

When the lock member **22** is further rotated in the clockwise direction, the main body **11** of the stopper is also rotated in a clockwise direction, the main body **11** of the stopper is also rotated in a clockwise direction so that the lock shaft **15** reaches the upper end portion of the shaft anchor groove **17** while being guided with the inclined guide portion **17***c* of the shaft anchor groove **17** along the inclined guide portion **17***c*. Then, at the position shown in FIG. **8**(*g*), the main body **11** of the stopper is suspended. In this case, the lock shaft **15** is guided with the inclined guide portion **17***c* so that the lock shaft **15** slides toward the side of the base end portion so that the slide member **21** slides toward the lock position. Then, the engaging projection portion **27***a* of the lock member **22** engages the engaging portion **24***a* of the slide member **21** that has slided to the lock position.

Thereafter, when the product S**2** to be sold next moves in a downward direction and comes down onto the main body **11** of the stopper, the main body **11** of the stopper is rotated in the counterclockwise direction with the weight of the product S**2** itself. In this case, the lock shaft **15** is guided in a downward directions with the vertical guide portion **17***b* to be anchored to the anchor portion **17***a*. As a consequence, as shown in FIG. **8**(*h*) or FIG. **8**(*a*), the main body **11** of the stopper is locked to the closed position.

As described above, the main body **11** of the stopper locked to the lock position via the lock shaft **15**, and at the same time, this lock shaft **15** is locked to the lock position with the slide member **21** and the lock member **22** so that the lock shaft **15** is double locked. As a consequence, the detachment of the lock shaft **15** from the anchor portion **17***a* of the shaft anchor groove **17** by the collision to the main body **11** of the stopper due to coming down of the product S at the time of refilling of the product and by tampering can be prevented with the result that the lock of the main body **11** at the closed position can be held with certitude. Furthermore, the slide member **21** can be locked at the lock

position with the lock member, and at the same time, the slide member is slided to the unlock position by the rotation of the lock member **22** with the result that the locking and unlocking of the main body **11** of the stopper with the lock shaft **15** can be both facilitated with lock member **22** having a simple structure.

Next, an ejector **5** above the main body **11** of the stopper will be explained which ejector is arranged between the side plates **7** and **7** to support the product S**2** to be sold next in collaboration with the passage wall **2***a*. The ejector **5** is constituted so as to move in a vertical direction and in an downwardly inclined direction toward to the front, and the ejector **5** has a main body **31** of the ejector (a member for supporting the product to be sold next) and a joint **32** (a connection member) for connecting the main body **31** of the ejector to the drive mechanism **6**.

As shown in FIG. **5**, the main body **11** of the ejector comprises four ejector plates **33** formed in a vertically long square configuration, three connection shafts **34** rotatably connecting the four ejector plates in a vertical state, an upper shaft **35***a* and a lower shaft **35***b* respectively attached on the upper end portion of the ejector plate **33** located at the upper most position and the lower end portion of the ejector plate **33** located at the lowermost position, the upper shaft and the lower shaft being constituted in the same manner as these connection shaft **34**. Both end portions of each of the connection shaft **34**, the upper shaft **35***a* and the lower shaft **35***b* are inserted loosely into the ejector guide groove **36** formed respectively on the both side plates **7** and **7**. Each of the ejector guide grooves **36** is formed in a bent configuration with a vertical guide groove **36***a* which extends vertically, and an inclined guide groove **36***b* connecting from the lower end of the vertical guide groove **36***a*, being inclined in a forward direction and extending toward the product to be sold S**1**. Incidentally, the inclined guide groove **36***b* of each of the ejector guide grooves **36** is extended so as to come close to the passage wall **2***a* rather than to the end portion on the side opposite to the passage wall **2***a* of the product S**1** to be sold.

The main body **31** of the ejector constituted in this manner moves vertically with respect to the joint while being guided with both ejector guide grooves **36** and **36**. Specifically, the main body **31** of the ejector slides between the allowing position (see FIG. **15**) for allowing the product S**1** to be sold next to move in a downward direction and the inhibiting position for inhibiting the downward movement of the product S**2** to be sold next by supporting the product S**2** to be sold next in collaboration with the passage wall **2***a*, the inhibiting position being defined with the contact of the main body **31** of thee ejector with the product S**1** to be sold. Incidentally, the maximum slidable scope of the ejector **31** is set between the position at which the upper shaft **35***a* comes into contact with the upper end of the vertical guide groove **36***a* and the position at which the lower shaft **35***b* comes into contact with the end of the inclined guide groove **36***b*.

Furthermore, as shown in FIG. **5**, the joint **32** has a main body **41** of the joint with a horizontally long square configuration, a pair of ejector connection portions **42** and **42** provided on a front surface of the main body **41** of the joint to sandwich the upper shaft **35***a* of the main body **31** of the ejector, a drive shaft connection portion **43** and a delivery shaft connection portion **44** provided on the rear surface of the main body **41** of the joint and having the drive shaft **52** and the delivery shaft **53** of the drive mechanism **6** described later inserted thereinto. Both side portions of the main body **41** of the joint are supported respectively with the rails **45** and **45** provided respectively on the above side plates **7** and **7** with the result that the main body **41** of the joint can be slided in a vertical direction along the rails **45** and **45** respectively. Both the drive shaft connection portion **43** and the delivery shaft connection portion **44** are both formed in such a manner that the cross sections thereof have a semi-circular configuration. At the same time, the through holes **43***a* and **44***a* are formed which extends in a vertical direction. In the through holes **43***a* of the drive shaft connection portion **43**, a female screw which engages the male screw formed on the surface of the drive shaft **52** is formed while the through hole **44***a* of the delivery shaft connection portion **44** is formed in a size such that the delivery shaft **53** can be inserted loosely thereinto.

Furthermore, on the passage wall **2***a*, as shown in FIG. **1**, the main body **31** of the ejector project to the product passage **2** to a predetermined length (in actuality, on the order of 3 to 5 mm) which is approximately the same as the height at which the main body **31** of the ejector supports the product to be sold next, and, at the same time, a support projection portion **2***b* is formed which extends to the same length as the horizontal width of the passage wall **2***a*. When the main body **31** of the ejector supports the product to be sold next in collaboration with the passage wall **2***a* by providing this support projection portion **2***b* on the passage wall **2***a*, the product S**2** to be sold is easily stuck on the passage wall **2***a*.

Next, a drive mechanism **6** will be explained for unlocking the main body **11** of the stopper with the lock means **12** while driving the ejector **5** at the same time. As shown in FIG. **5**, the drive mechanism **6** has a drive motor S**1** (a drive source), a drive shaft **52** which is rotated and driven around an axial line with the drive motor (the drive source), a delivery shaft **53** arranged in parallel with the drive shaft **52** for delivering all the products S at one time at the time of exchanging all the products accommodated in the product passage **2**, and a gear box **54** having a speed reducing gear row (not shown) for transmitting the drive force of the drive motor **51** to the drive shaft **52**.

On the drive shaft **52**, as shown in FIG. **5**, on a portion upper than the gear box **54**, a male screw is formed which engages the female screw of the drive shaft connection portion **43** of the joint **32** with the result that the drive shaft **52** is inserted into the through hole **43***a* of the drive shaft connection portion **43** in the state in which the male and the female screws are engaged with each other. As a consequence, when the drive shaft **52** is rotated around the axial line, the joint **32** moves in a vertical direction with the result that the main body **31** of the ejector slides between the allowing position and the inhibiting position. Furthermore, on the lower end portion projecting downward from the gear box **54**, a small diameter portion **52***a* of the drive shaft extending in an axial direction and having a diameter smaller than the upper shaft diameter of the of the gear box of the drive shaft **52**, and a large diameter portion **52***b* of the drive shaft (a first unlocking means and unlocking member) connecting the lower end of the small diameter portion **52***a* of the drive shaft, extending in an axial direction and having the same diameter as the shaft diameter. This small diameter portion **52***a* of the drive shaft is loosely inserted into one of the notches **28***a* of the locking member **22** while the large diameter portion **52***b* of the drive shaft becomes larger than the horizontal width of the notch **28***a* of the locking member. Consequently, as described later, the drive shaft **52** is driven in an upward direction so that the large diameter portion **52***b* of the drive shaft presses the vicinity of the notches **28***a* of the locking member from the lower side with the result that

the locking member **22** is rotated by pulling up the connection portion **28** of the locking member **22**.

Furthermore, as shown in FIG. **3**, a compression spring **56** (a second energizing means) for energizing the drive shaft **52** in a downward direction is inserted into the bearing **55** of the upper end portion of the drive shaft **52**. Consequently, as described later, when the drive shaft **52** is driven in an upward direction, the compression spring **56** is compressed. When the driving of the drive shaft **52** in an upward direction is released, the drive shaft **52** is driven in a downward direction with the return force of the compression spring **56**. Incidentally, in the place of such compression spring **56**. a pull spring may be provided for energizing the drive shaft **52** in a downward direction on the lower end portion of the drive shaft **52**. Furthermore, the drive shaft **52** in the gear box **54** is loosely inserted into the gear (not shown) which engages the speed reducing gear (not shown), and the cross section of the drive shaft **52** at the portion which is loosely inserted into the gear is formed in a regular hexagonal configuration or a D-like configuration. As a consequence, the drive force of the driving motor **S1** can be transmitted to the drive shaft with certitude via the gear (not shown). At the same time, the drive shaft **52** can be moved in a vertical direction without moving the gear up and down.

On the other hand, the delivery shaft **53** is constituted approximately in the same manner as the drive shaft **52** except for the fact that a male screw is formed on the surface with respect to the drive shaft **52**. However, on an upper portion of the delivery shaft **53**, a pressed portion **57** which is pressed to the upper end portion of the main body **41** of the joint when the main body **31** of the joint moves further upward exceeding the allowing position of the main body **31** of the ejector.

Here, unlocking of the main body **11** of the stopper and driving of the main body **31** of the ejector by the drive mechanism will be explained in order with respect to the time of selling the product and the time of exchanging the product. In the beginning, at the time of selling the product, the drive motor **51** of the drive mechanism is operated and rotated in a normal direction. When the drive shaft is rotated and driven in a predetermined direction, the joint engaging the drive shaft moves in a downward direction. Along with this, the main body **31** of the ejector slides toward the inhibiting position. Then, the lower end of the main body **31** of the ejector comes into contact with the upper portion of the product **S1** to be sold, and the main body **31** of the ejector reaches the inhibiting position (see FIG. **10**), the joint **32** which has moved in a downward direction is suspended. When the drive shaft continues to rotate after the main body **31** of the ejector reaches the inhibiting position, the drive shaft **52** moves in an upward direction with respect to the joint **32** which is suspended while compressing the compression spring **56**. As a consequence, when the lock member **22** at the engaging position which member is connected to the lower end portion of the drive shaft **52** is rotated and driven toward the detachment position, the lock of the main body **11** of the stopper at the closed position is unlocked. As a consequence, the main body **11** of the stopper is rotated and driven toward the open position with the weight of the product **S1** to be sold with the result that the product **S1** to be sold is delivered from the product passage **2**. When the contact of the main body **11** of the ejector to the product **S1** to be sold is released by the delivery of the product to be sold, the drive shaft **52** is driven in a downward direction with the return force of the compression spring **56** to return to the original position.

On the other hand, at the time of exchanging the products, when a predetermined button (instruction means) not shown is operated which is operated for supporting the delivery of all the products at one time which are accommodated in the product passage **2**, the drive motor **51** is operated in a reverse direction unlike the time of selling the products with the result that the drive shaft is also rotated in a reverse direction. Consequently, the joint **32** moves in an upward direction, and along with this, the main body **31** of the ejector moves further in an upward direction over the allowing position. Then, the upper end portion of the main body **41** of the joint presses the pressed portion **57** from the lower side with the result that the delivery shaft **53** is raised in an upward direction. As a consequence, the lock member at the engaging position which member is connected to the lower end portion of the delivery shaft **53** is rotated and driven toward the detachment position so that the main body **11** of the stopper at the closed position is unlocked.

In this manner, the main body **31** of the ejector moves in an upward direction at least above the allowed position, and the main body **11** of the stopper at the closed position is unlocked so that all the products S in the product passage are delivered at one time. Consequently. in the case where a plurality of products are already accommodated in the product passage **2**, and these products S are exchanged with other products, all the products S accommodated in the product passage **2** can be delivered at one time and in a package by the operation of the predetermined button by the operator with the result that exchange work of the product S can be conducted in a short time. In this manner, the second unlocking means of the present invention for delivering all the products S accommodated in the product passage **2** at one time comprises a delivery shaft **53**, a drive mechanism **6**, and an ejector **5**.

Next, referring to FIGS. **9** through **30**, the delivery of the product S having each kind of size and configuration by the product delivering device which is constituted as described above will be explained in this manner.

Specifically, there will be explained a case in which the product S accommodated in the product passage **2** is accommodated, a case in which the product S is a thin canned product (FIGS. **9** through **15**), a case in which the product S is a thick canned product (FIG. **16**). a case in which the product S is a square PET bottle (FIGS. **17** through **23**), and a case in which the thin canned products and thick canned products are mixed and. accommodated in the product passage (FIGS. **24** through **30**). Incidentally, in the forgoing explanation, there will be explained the delivery of products in the case where the thin canned products are accommodated in the product passage. With respect to the delivery of products in other cases, different points will be explained.

FIG. **9** is a view showing a product delivering device **1** which accommodates thin canned products in the product path **2** and which is set in the sales waiting state. The main body **11** of the stopper is located in the closed state, and the main body **31** of the stopper supports the product **S1** to be sold from the lower side and the product to be sold **S1** supports the lower side of the product to be sold next **S2**.

When the state moves from the sales waiting state to the sales state, the drive motor **51** rotates in the normal direction. The drive shaft **52** is rotated in a downward direction on the basis of the rotation in a predetermined direction of the drive shaft **52** to allow the main body **31** of the ejector to slide toward the inhibiting position. Next, as shown in FIG. **10**, the main body **31** of the ejector comes into contact with the upper portion of the sales product **S1** by the sliding along the ejector guide groove **36** to come into contact with the upper

portion (the inhibiting position) of the product S to be sold thereby suspending the operation. The joint **32** suspends the movement in a downward direction on the basis of the suspension of the main body **31** of the ejector. The drive motor **52** relatively moves the drive shaft **52** in an upward direction with respect to he joint **32** by a continuous rotation even after the main body of the ejector reaches the inhibiting position. Next, as shown in FIG. **11**, the lock member **22** is rotated in a counterclockwise direction on the basis of an upward movement of the drive shaft **52** to unlock the main body **11** of the stopper. The slide member **21** slides on the basis of the unlocking of the main body **11** of the stopper. Next, as shown in FIG. **12**, the main body **11** of the stopper is rotated in a counterclockwise direction toward the open position centering on the rotation shaft **13** with the weight of the product **S1** to be sold. The main body **11** of the stopper opens the product passage **2** on the basis of the fact that the main body **11** of the stopper is rotated toward the open position with the result that the product **S1** to be sold is allowed to come down in a downward direction to be delivered to the sales port (not shown).

At this time, the main body **31** of the ejector supports the product **S2** to be sold next in collaboration with the passage wall **2***a*. When the product **S2** to be sold next is detached from the main body **31** of the ejector with the delivery from the vending machine, the drive shaft **52** which has moved upward is energized in a downward direction with the return force of the compression spring **56** to return to the original position. The drive motor **51** suspends the operation when the return of the drive shaft **52** to the original position is detected.

When the product **S1** to be sold is delivered, the lock member **22** is rotated in the clockwise direction centering on the rotation shaft **13** with the return force of the pull spring **29**. The lock member **22** presses the main body **11** of the stopper **11** from the lower side with the engaging projection portion **27***a* on the basis of the rotation. Next, as shown in FIG. **14**. the main body **11** of the stopper is rotated in the clockwise direction to a position at which the lock shaft **15** together with the lock member **22** comes into contact with the upper end portion of the shaft anchor groove **17**. Next, when the drive motor **51** is rotated in a reverse direction, the drive shaft **52** is rotated is a direction opposite to the rotation direction. The joint **32** moves in an upward direction on the basis of the rotation of the drive shaft **52**. The main body **31** of the ejector slides to the allowing position on the basis of the rise of the joint **32**. When the main body **11** of the ejector reaches the allowing position, the product **S2** to be sold next moves in a downward direction and comes down onto the main body **11** of the stopper. The main body **11** of the stopper is rotated to some extent with the weight of the product **S2** to be sold next. As shown in FIG. **15**, the main body **11** of the stopper suspends at the closed position. The drive motor **51** is suspended when the fact that the product **S2** to be sold next comes down on the main body **11** of the stopper is detected with the means for detecting the product to be sold comprising a senor or the like (not shown). The product **S2** to be sold next which comes down on the main body **11** of the stopper is the product to be sold at the time of the next sales.

FIG. **16** is a view showing the product to be sold next which accommodates the thick canned product in the product passage **2** and which is set to the sales waiting state. In this case, the product delivering device **1** is operated in the same manner as the above product delivering device **1** for delivering the thin canned products except for the fact that the allowing position and the inhibiting position are recessed than the case in which the thin canned products are delivered.

FIGS. **17** through **23** are views showing the product delivering device **1** in the case where square PET bottle products are accommodated in the product passage **2**, FIGS. **17** through **23** corresponds to FIGS. **9** through **15** showing the delivery of the thin canned products which has been explained above. FIG. **18** is a view showing the state in which the main body **31** of the product comes into contact with the product **S1** to be sold next. The main body **31** of the ejector supports the chamfered portion at two locations of the lower portion of the product to be sold next in collaboration with the main body **31** of the ejector and the support projection portion **2***b* of the passage wall **2***a*. As a consequence, square PET bottles to be sold next can be appropriately supported as compared with the case in which the product **S2** to be sold next is supported in collaboration with the main body **31** of the ejector, and the passage wall **2***a* without the support projection portion **2***b*.

FIGS. **24** through **30** are views showing an operation of the product delivering device **1** in the case in which thick canned products and thin canned products are mixed and accommodated in the product passage **2**. FIGS. **24** through **30** corresponds to FIGS. **9** through **15** showing the delivery of thin canned product as has been explained above. As shown in FIG. **24**, when the product **S1** to be sold is thick canned product and the product **S2** to be sold next is a thin canned product, the inhibiting position of the main body **31** of the ejector is set to a position corresponding to the thick canned product. When the product to be sold is a thin canned product (see FIG. **10**), the position is set to a position recessed more. At this inhibiting position, there is a fear that the main body **31** of the ejector cannot support the product to be sold next, which is the thin canned product in collaboration with the passage wall **2***a*. However, the main body **31** of the ejector slides further to the side of the passage wall **2***a* over the initial inhibiting position, as shown in FIG. **27** because the drive shaft **52** moves in a downward direction with the return force of the compression spring at the same time when the contact of the main body **31** of the ejector with the product **S1** to be sold is released with the delivery of the product **S1**. Consequently, even in the case where thick canned products and thin canned products are mixed and accommodated in the product passage **2** on purpose, and even in the case where products having different sizes are accommodated in the product passage **2** by mistake, the main body **31** of the ejector can support the product **S2** to be sold next in collaboration with the passage wall **2***a* thereby preventing selling large number of products.

As has been explained above, according to the product delivering device of the present invention, since the inhibiting position at which the main body **31** of the ejector supports the product **S2** to be sold next can be appropriately set automatically and steplessly in accordance with the size and the configuration of the product, only the product to be sold **S1** can be delivered with certitude at the time of selling the product irrespective of the size and the configuration of the product S to be sold with the result that the flexibility of the product delivering device **1** with respect to the product S to be sold.

Furthermore, since the lock mechanism **18** for locking the main body **11** of the product to be sold to the closed position is arranged between the side plates **7** and **7**, the width of the product delivering device **1**, namely, generally, the width of the product delivering device in the right and the left direction of the automatic. vending machine can be made small. As a consequence, the product delivering device can be constituted in a compact size, and can be installed in a limited space with the result that the width in the right and the left direction can be made small.

Furthermore, when the lock member **22** located at the engaging position is rotated and driven to the detachment position against the pull spring **29** with the drive mechanism, the engaging projection portion **27** of the lock member **22** is detached from the slide member **21** and is set to the state in which the, lock member is not in contact with the main body **11** of the stopper with the result that the energizing force of the pull spring **29** ceases to be transmitted to the main body of the stopper. Consequently, when the main body **11** of the stopper at the closed position is unlocked, the main body **11** of the stopper can be easily rotated to the open position with the weight of the product S1 to be sold can be delivered with certitude,

Incidentally, the present invention can be practiced in various forms without being restricted to the embodiments which have been explained. Furthermore, detailed structure of the product delivering device shown in the embodiments are shown only as an illustration, and can be appropriately modified within the scope of the gist of the present invention.

As has been described in detail, the product delivering device of the automatic vending machine of the present invention has an advantage of delivering only products to be sold with certitude at the time of selling the products irrespective of the size and the configuration of the product to be sold.

What is claimed is:

1. A product delivering device of an automatic vending machine comprising:

a stopper which projects into a product passage to support a product to be sold;

an ejector which projects into the product passage to support a product to be sold next after the product to be sold; and

control means for controlling a projection quantity to the product passage of the ejector;

wherein the control means allows the ejector to project into the product passage to support product to be sold next upon receipt of a sales instruction, and at the same time, opens the stopper to deliver the product to be sold from the product passage to the sales port thereby closing the product passage with the stopper after the delivery of the product to be sold while supplying the product to be sold next on the stopper by allowing the ejector to be recessed.

2. The product delivering device of the automatic vending machine according to claim **1**, wherein the ejector projects into the product passage in the projection quantity in accordance with the size of the product to be sold accommodated in the product passage.

3. A product delivering device of an automatic vending machine comprising:

a stopper which projects into a product passage to support a product to be sold;

an ejector which projects into the product passage to support a product to be sold next after the product to be sold; and

drive means having a drive shaft for driving the stopper and the ejector with the movement into an axial direction on the basis of the rotation movement;

wherein the drive means drives the stopper and the ejector to deliver the product to be sold to a sales port by constraining the product to be sold next after the product to be sold by the rotation of the driving shaft in a first direction, moves the stopper to the sales waiting position by rotating the driving shaft in a second direction and, at the same time, driving the stopper and the ejector so as to supply the product to be sold next to the sales waiting position from the product passage.

4. The product delivering device of the automatic vending machine according to claim **3**, wherein the stopper has drive portion rotatably supported on a fixed system via a rotation shaft to receive a drive force from the drive means, and a rotation member formed of an opening and closing portion for opening and closing a product passage on the basis of the drive force.

5. The product delivering device of the automatic vending machine according to claim **3**, wherein the ejector has a plate-like member which projects in an inclined manner into a product passage on the basis of the driving of the drive means, and a guide groove for guiding both ends of the plate-like member.

6. The product delivering device of the vending machine according claim **3**, wherein the drive means has a drive motor which generates a rotation force for rotating the drive shaft in a first or a second direction, a first screw portion provided on the drive shaft for converting the rotation force into a to and fro movement into an axial direction of the drive shaft, a second screw portion engaging with the first screw portion and a joint portion engaged with the ejector to be supported on the drive shaft in such a manner that the joint portion can be moved to and fro.

7. A product delivering device of an automatic vending machine for delivering a product located at the lowest position out of a plurality of products accommodated in a product passage in a downward direction at the time of selling the product in the state in which the plurality of products placed in a horizontal direction are stacked in a vertical direction, the device comprising:

opening and closing means of the product passage movable between a closed position for closing the product passage so as to inhibit the delivery of the product to be sold, and an open position for opening the product passage so as to allow the delivery of the product, the means being capable of being driven toward the open position from the closed position with the weight of the product to be sold;

allowing means for allowing the movement in a downward direction the product to be sold next located immediately on the product to be sold;

means for supporting the product to be sold next movable between the allowing position for allowing the downward movement of the product to be sold next located immediately on the product to be sold and an inhibiting position for inhibiting the downward movement of the product to be sold next by supporting the product to be sold next in collaboration with the passage wall located opposite to the product passage, the inhibiting position being defined in contact with the upper portion of the product to be sold;

driving means for driving the means for supporting the product to be sold next between the inhibiting position and the allowing position;

locking means for locking the product opening and closing means to the closed position; and

a first unlocking means for unlocking the lock of the opening and closing means of the product passage by the locking means when the means for supporting the product to be sold next moves to the inhibiting position at the time of selling the product.

8. The product delivering device according to claim **7**, wherein a projection portion having a height projecting to a

predetermined length is provided on the passage wall, the height being approximately the same as the height at which the means for supporting the product to be sold next supports the product to be sold next.

9. The product delivering device according to claim **7** or **8**, wherein the opening and closing means of the product passage has:

an opening and closing member which rotates on the base end portion between the closed position and the open position, the member having a long hole-like through hole extending in parallel with the rotation axial line and having a cross section extending in radial direction with respect to the center of the rotation; and

a pair of guide portions provided opposite to each other with the opening and closing means located therebetween and extending in arc-like configuration centering on the rotation axis for guiding the opening and closing member between the closed position and the open position,

and the locking means has a lock shaft being inserted loosely into the through hole of the opening and closing means, and, at the same time, having both end portions projecting to the outside engaging the pair of guide portions respectively,

the lock shaft being slidable in a direction of the through hole when the opening and closing member is located at the closed position,

an anchor portion provided respectively on the pair of guide portions so as to be projected in a radial direction with respect to the center of rotation to anchor the lock shaft, and a lock mechanism for locking the lock shaft into the anchor portion.

10. The product delivering device of the automatic vending machine according to claim **9**, wherein the through hole of the opening and closing member is provided on the end portion of the opening and closing member.

11. The product delivering device of the automatic vending machine according to claim **9** or **10** wherein the lock mechanism is arranged between a pair of guide portions.

12. The product delivering device of the automatic vending machine according to claim **9** or **11**, wherein the lock member has a slide member attached with the lock shaft and constituted slidably between the lock position at which the lock shaft anchors the anchor portion of the pair of guide portions, and the unlock position at which the lock shaft is detached from the anchor portion; the slide member having an engaging portion; and

a lock member detachably constituted in the engaging portion of the slide member to lock the slide member at the lock position by engaging the engaging portion of the slide member when the slide member is located at the lock position.

13. The product delivering device of the automatic vending machine according to claim **12**, wherein the lock member is constituted rotatably between the engaging position for engaging the engaging portion of the slide member, and the detachment position for detaching from the engaging portion, and a pressing portion for sliding the slide member from the lock position to the unlock position by pressing the slide member when the lock member is rotated from the engaging position to the detachment position.

14. The product delivering device of the vending machine according claim **13**, wherein the lock mechanism has a first energizing means for energizing the lock member to be rotated from the detachment position to the engaging position, so that the lock member is rotated from the open position to the closed position by pressing the opening and closing member when the opening and closing member is located at the open position and is rotated from the detachment position to the engaging position with the first energizing means.

15. The product to be sold of the automatic vending machine according to claim **13** or claim **14**, wherein the means for supporting the product to be sold next has a member for supporting the product to be sold next. the member being constituted slidably between the allowing position and the inhibiting position and a connection portion having a female screw and being movable in a vertical direction for connecting the means for supporting the product to be sold next to the drive means; and

the drive means has a drive source and a drive shaft having a male screw on the surface thereof which is constituted in such a manner that the drive shaft extends in a vertical direction and is movably provided in a vertical direction to be rotated and driven in a predetermined direction around an axial line with a drive source with the result that the drive shaft moves the member for supporting the product to be sold next toward the inhibiting position around an axial line with the drive source via a connection member which moves in a downward direction, and the drive shaft is further rotated and moved in a predetermined direction with the drive source after the means for supporting the product to be sold next comes into contact with the product to be sold so that the drive shaft is moved in an upward direction;

the first unlocking means has an unlocking member provided on the lower end of the drive shaft, and at the same time, connected to the lock member, and rotates the lock member from the engaging position to the detachment position along with an upward movement of the drive shaft.

16. The product delivering device of the vending machine according to claim **15**, wherein the drive means further has a second energizing means for energizing the drive shaft in a downward direction, and the second energizing means is further rotated and driven in a predetermined direction with the drive force after the member for supporting the product to be sold next comes into contact with the sales product so that the second energizing means is compressed or pulled with the drive shaft which moves in an upward direction and the product to be sold is delivered with the result that the drive shaft is driven in a downward direction with a return force when the contact of the product to be sold with the member for supporting the product to be sold next is released.

17. The product delivering device according to any one claim of claims **7** through **16** further comprising instruction means which is operated for instructing the delivering of all the product accommodated in the product passage at one time and second unlocking means for unlocking the opening and closing means of the locking means.

* * * * *